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A HAPPY NEW YEAR.

The closing of 1909 witnesses a far different business aspect to that which confronted us a year ago. While we all of us were in a cheerful frame of mind and there was abroad a feeling of hardy optimism, it was with more or less apprehension for the future that we took up the work for another year. The promises of a year ago for a large development in business and a steady return of prosperity has been realized. Business has resumed its present activity through a comparatively even acceleration. At no season has there been a pronounced impetus except during the last month or two. Today, notwithstanding enlargements made during the dull season and the opportunities which were presented for the reorganization of plants and the securing of raw material at a low cost, shipments are considerably behind orders. But in all cases the curve is showing an upward movement and an expression of opinion from the leaders in every department of the industry seems to indicate that the outlook for 1910 is bright, indeed.

This, then, should constitute a Happy New Year for all of us, and this is the wish which we gratefully make to all and for all of our friends.

A NEW LAMP ANNOUNCEMENT.

Ever since the introduction of the high-efficiency incandescent lamps there has been a good deal of discussion as to the fitness of the various types of lamps for peculiar conditions of service. Not every lamp will fit every character of lighting scheme, and apart from the excellent work which has been done by a comparatively few good illuminating engineers, there has been a more or less heterogeneous choosing of lamp units with little or no co-ordinated effort upon the part of the manufacturer, the central station, the engineer and the consumer.

The metal filament lamp is essentially a laboratory product. Therefore, the announcement published on other pages of this issue concerning the new "Mazda" lamp is of great importance and marks a step in advance. The beginning of the new year will see changes in the lamp industry and in the utilization of electric lamps on electric lighting circuits. The organization of the foremost lamp companies of this country to secure the benefits of highly specialized skill in lamp manufacture is sure to redound to the ultimate benefit of every user of electric light.

WHEN CONGRESS TAKES HYDROELECTRIC PLANTS.

Congress may affect the values of hydroelectric plants without paying compensation, in the exercise of its power over navigation, but where such a plant is taken it must be paid for. The great question where a hydroelectric plant is damaged by acts done under the authority of Congress is thus whether these acts amount to a legal taking of property. Where there is a taking of such a plant, a further question relates to the elements of property that must be covered by the compensation.

The leading case where a hydraulic structure necessary to the exercise of a franchise has been taken by the United States is Monongahela Navigation Company v. United States, 148 U. S., 312, decided in 1893 by the Supreme Court.

The facts in the above case were that Congress directed the Secretary of War to take a lock and dam in the Monongahela River by eminent domain for purposes of navigation, and the act provided compensation for the lock and dam, but that nothing should be added for the right to take toll. By an act of Pennsylvania, in 1836, the Monongahela company had been incorporated and authorized to construct locks and dams and to collect toll for their use in navigation, and the lock and dam in question were devoted to this use.

In the opinion of the court deciding that the Monongahela company was entitled to compensation for its franchise to take toll, as well as for the lock and dam, Mr. Justice Brewer said:

"Congress has supreme control over the regulation of commerce, but if, in exercising that supreme control, it deems it necessary to take private property, then it must proceed subject to the limitations imposed by the Fifth Amendment, and can take only on payment of just compensation. * * * * And if that property be improved under authority of a charter granted by the State, with a franchise to take tolls for the use of the improvement, in order to determine the just compensation, such franchise must be taken into account. Because Congress has power to take the property, it does not follow that it may destroy the franchise without compensation. Whatever be the true value of that which it takes from the individual owner must be paid to him, before it can be said that just compensation for the property has been made."

Under the rule of the above case, it is clear that a hydroelectric company would be entitled to compensation when any of its plant was taken by the authority of Congress, and this compensation might include the value of its franchise to develop power by means of the river. The question remains, however, how far Congress may go in affecting the water power of an electric company before there is a legal taking of the property.

On this last point the strongest Supreme Court case is Pumpelly v. Green Bay Company, 13 Wallace 166, where it was decided that land was taken when it was overflowed with water as an incident to the improvement of navigation under government authority. In this case the facts were that one Pumpelly had his land overflowed by reason of a dam constructed in the Fox River, under the authority of the Legislature of Wisconsin, to improve navigation.

The Wisconsin statute made no provision for compensation to persons whose land might be overflowed by reason of the dam, and it was argued that the state had the right to inflict such damage for the purpose of improving navigation, without paying compensation.

In deciding that the overflow of the land in question was such a *taking* as entitled the owner to compensation, Mr. Justice Miller said for the Supreme Court:

"It would be a very curious and unsatisfactory result, if in construing a provision of constitutional law, always understood to have been adopted for protection and security to the rights of the individual as against the Government, and which received the commendation of jurists, statesmen, and commentators as placing the just principles of the common law on that subject beyond the power of ordinary legislation to change or control them, it shall be held that if the Government refrains from the absolute conversion of real property to the uses of the public it can destroy its value entirely, can inflict irreparable and permanent injury to any extent, can, in effect, subject it to total destruction without making any compensation, because, in the narrowest sense of that word, it is not taken for the public use. Such a construction would pervert the constitutional provision into a restriction upon the rights of the citizen, as those rights stood at the common law, instead of the Government, and make it an authority for invasion of private right under the pretext of the public good, which had no warrant in the laws or practices of our ancestors." * * * *

"We are not unaware of the numerous cases in the State courts in which the doctrine has been successfully invoked that for a consequential injury to the property of the individual arising from the prosecution of improvements of roads, streets, rivers and other highways, for the public good, there is no redress; and we do not deny that the principle is a sound one, in its proper application, to many injuries to property so originating. * * * * But we are of opinion that the decisions referred to have gone to the uttermost limit of sound judicial construction in favor of this principle, and, in some cases, beyond it, and that it remains true that where real estate is actually invaded by superinduced additions of water, earth, sand, or other material, or by having any artificial structure placed on it, so as to effectually destroy or impair its usefulness, it is a taking, within the meaning of the Constitution, and that this proposition is not in conflict with the weight of judicial authority in this country, and certainly not with sound principle."

The above decision appears to be broad enough to cover the case of a hydroelectric company whose water power is reduced or destroyed by Government operations in lakes or rivers for the improvement of navigation.

Theodore N. Vail.

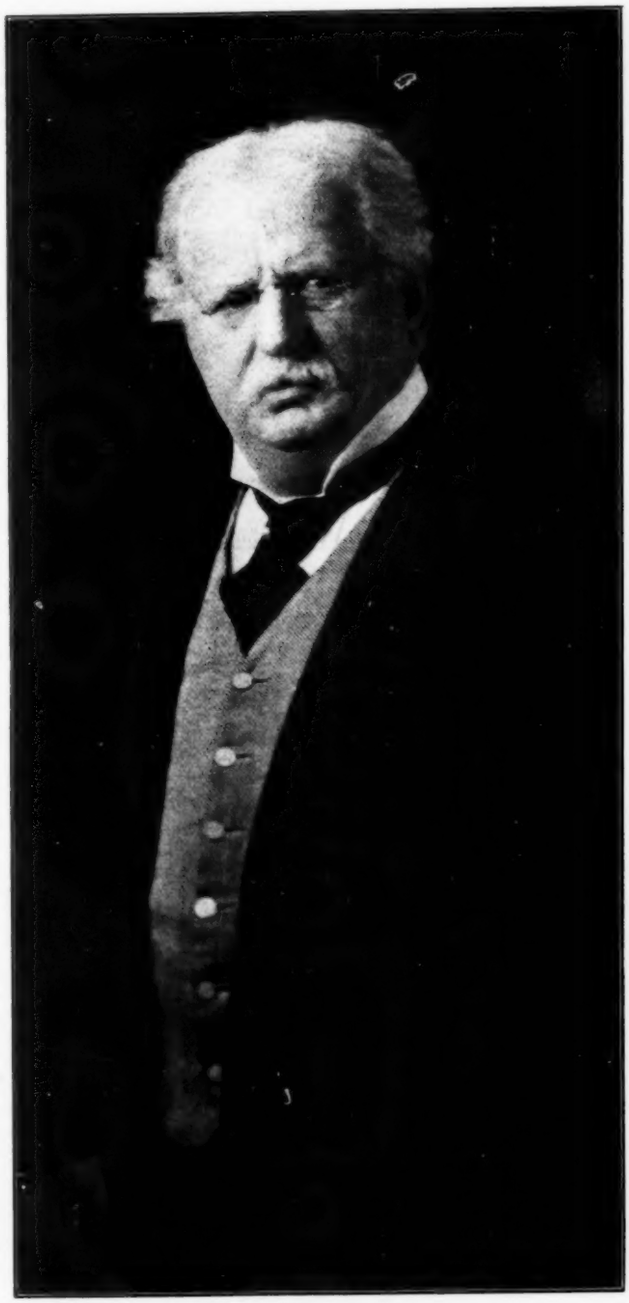
Theodore Newton Vail, president of the American Telephone and Telegraph Company, was born in Ohio on July 16, 1845. On his father's side he is descended from the English Quakers, who early settled in Massachusetts. Later some of the family went to Westchester County, New York, and then to Morris County, New Jersey, in which county the ninth generation is now living. His mother's people were early Dutch and French settlers of New York and New Jersey.

Mr. Vail was educated in the Morristown common school and the Morristown academy. He took up the study of medicine, but gave it up to learn telegraphy. For a time he was an operator in New York, and then went West in the employ of the Union Pacific Railroad. He was appointed to the railway mail service at the close of the Civil War, and for six years had a run from Omaha to Ogden, residing in Omaha. In 1873 he became connected with the office of the general superintendent of railway mails, Washington, D. C., a year later being made assistant superintendent of that department. In 1875 he was made assistant general superintendent, and in 1876 general superintendent. He reorganized the railway mail system, rendering it very much more efficient.

In Washington he became acquainted with Professor Bell and Gardiner Hubbard, and joined with them in developing the telephone industry. For several years he was interested in the early organization of the telephone business, molding its affairs in a masterly and farseeing manner as general manager of the American Bell Telephone Company, but gave up active participation to become engaged in railway and electrical enterprises in Europe and South America. The electric street railway system of Buenos Aires was inaugurated by him, and he also developed power transmission systems in a number of the neighboring states. After carrying these enterprises to a high degree of success, he disposed of his interests to South American and European capitalists in 1907.

Mr. Vail always retained his interest in the telephone industry, and after disposing of his South American investments became president of the American Telephone and Telegraph Company, when it had taken over all the Bell interests. This position carries with it the presidency or directorship of nearly every subsidiary company in the United States, and his administration has been most successful and popular—both financially and in operating the vast business to the satisfaction of the public and the investor.

Mr. Vail is a man of striking and interesting personality, who numbers his friends by the score, and undoubtedly to him more than any one else is due the wonderful development of the telephone.



THEODORE N. VAIL.
President of the American Telephone and Telegraph Company.

Commercial Cable Company Employes Entertained.

A theatre party was given by Clarence H. Mackay at the New Theatre, New York, on December 23, to the New York officers and staff of the Commercial Cable Company, of which Mr. Mackay is president. The party was in celebration of the twenty-fifth anniversary of the company. Among the officers present were George G. Ward, vice-president and general manager of the Commercial Cable Company; Edward J. Nally, vice-president and general manager of the Postal Telegraph-Cable Company; George Clapperton, traffic manager of the Commercial; S. Dickenson, general superintendent; Albert Beck, secretary; E. C. Platt, treasurer; C. C. Adams and C. P. Bruch, vice-presidents of the Postal, and Col. A. H. Chandler, a former president of the Postal. Mr. Mackay also gave a banquet to the officers and staff on December 27.

Valuation of Brooklyn Rapid Transit Properties.

The physical valuation of the Brooklyn Rapid Transit properties in the various roads operated in the system is estimated at a total of $103,216,789. These are the complete figures for the several roads calculated by Bion J. Arnold, consulting engineer of the Public Service Commission of New York, and were submitted by him at a hearing upon the matter of the Coney Island ten-cent fare held recently. His former estimate was $100,000,000.

A Review of the Year in the Electrical Industry.

The promise of a year ago that there would be a continuous development in engineering, in financing and in manufacturing in the electrical field, has been well substantiated. A year ago we were slowly recovering from a severe depression, but there was a note of optimism evident that has been preserved and increased in richness during the entire year. From every direction come reports that the industry is again on its feet, and the developments have been of a most satisfactory nature. As a matter of fact there has been nothing startling in scientific attainment, or in the manufacturing enterprise, simply a slow and sure improvement of every phase of electrical application.

The brief review which follows of the several fields of endeavor into which the electrical industry may be divided is based upon the opinions of leaders in these fields, who have contributed very generously their suggestions as to what has constituted the essentials of whatever developments there may have been in their respective lines.

Telephone and Telegraph.

The telephone and telegraph industry, the oldest in the commercial applications of electrical phenomena, has been the subject of little change from an engineering or technical standpoint. There has been continued improvement in the matter of switchboard design, the elimination of parts, and the compacting of the apparatus. The policy of the American Telephone and Telegraph Company, in connecting up with independent and mutual companies, and the selling of standard apparatus to the smaller companies, has resulted in an overall improvement of service. Trunking capacity has been increased through the use of semi-automatic systems, and there have been a few new installations of auto-manual systems which have increased the prestige and usefulness of this system of semi-automatic telephone operating. All of the operating companies in larger cities have witnessed remarkable growths in the number of subscribers, and the appropriations for extensions and maintenance have reached extraordinary proportions. During last year there was a great deal of investment work done, due to the fact that money during the spring of the year was easy to secure, labor cost was low, and the material cost also considerably below that which prevails in boom times. Due to this fact underground conduit systems have been installed which will take care of some of the growth of the near future. Toll lines have been increased, and arrangements made whereby long-distance service may be secured at very low rates at specified hours during the day, thus greatly increasing the long-distance traffic.

The Independent telephone companies held an important meeting in Boston about a year ago. It is understood that these companies represented an invested capital of nearly $400,000,000.00. It was the purpose of this meeting to discuss a comprehensive system for handling long-distance traffic by Independent companies. A company has been organized to issue interchangeable long-distance coupons, acceptable by all the Independent companies. The clearing company is called the Independent Telephone Accounting Company. This company issued a coupon book which was guaranteed by companies in Pennsylvania, Michigan, New York, Kansas, West Virginia, Minnesota and Ohio, representing about 360,000 miles of wire.

Probably the most important development in the financial aspect of the telephone business was the securing control of a large portion of the stock of the Western Union Telegraph Company by the American Telephone and Telegraph Company. This purchase was carried out with a view of harmonizing the traffic operations of these two companies, increasing the efficiency of the service, and bringing about such betterments in the working of both telephone and telegraph lines that there would ultimately be a decrease in the cost to the subscriber, and a vast increase in the utilization of this form of communication.

Considerable stir was occasioned during the last few months of the year by the sale of the controlling interest in the Columbus Citizens Telephone Company, which included the lease of the Franklin County Telephone Company. The interests making this purchase were also involved in the purchase of the United States, Toledo Home and Cuyahoga Telephone Companies in Ohio, and the New Long Distance Telephone Companies of Indiana, represented by James S. Braily, Jr., of Toledo. This controlling interest, it has been stated, is about $1,500,000.

The report of the Bureau of Census for the telephone industry for the year ending December 31, 1907, gives the number of systems and lines as 22,971; the miles of single wire 12,099,369; the estimated messages or talks during the year 11,372,605,063; the total income $184,461,747; the total cost of construction and equipment $819,667,008; the capital stock authorized $1,121,931,023; the par value of stock and bonds outstanding $814,616,004.

According to the same statistics there were 25,298 salaried employees, being paid $19,298,423, and 118,871 wage earners, being paid $48,980,704.

According to these statistics the Bell system is largely predominant, with over 3,000,000 stations, exclusive of farmers, rural and mutual lines to which connection is made.

The census report for the year ending December 31, 1907, gives the number of telegraph systems or companies as 25, with 1,577,961 miles of single wire, exclusive of ocean cable, of which there are 46,301 miles. There was a total of 103,794,000 messages, with a total income of $51,583,868. The cost of construction and equipment, including real estate, was $210,045,959. The authorized capital stock was $161,603,900, and the total par value of stock and bonds outstanding $220,293,575, the average number of employees 28,034, with salaries and wages of $17,808,249.

There have been few technical developments in wire telegraphy. There have been improvements in service, making for a general increased efficiency of working. The printer system, after five

years' experience over all kinds of long and difficult circuits, has proven entirely reliable, efficient and economical, so that one company at least expresses its opinion that there is no room for doubt that machine telegraphy has successfully filled a long-felt want, and more than fulfilled the most sanguine predictions and expectations of its pioneer workers.

Cable Systems.

There is little to report in the development of cable systems, except that the improving condition of business in general has brought the traffic up to a normal increase over the work of a year ago. New devices are being tried from time to time, but few have been discovered during the past quarter century that have proven of any practical benefit in submarine cables.

The Commercial Cable Companies completed the laying of its new cable from St. Johns, New Foundland, to New York. This line is 1,307 miles long, and the line across the ocean taps the main line 270 miles east of St. Johns. It is claimed that the new line will vastly increase the speed of transmission. The Western Union Telegraph Company has quadruplexed its Cuba cable, this representing a distinct advance in the method of applying the multiplex principle of operation to practical submarine telegraphy. The cable is some ninety miles in length, and has a capacity equal to about 24,000, a value entire too high for practical cable working with a regular standard quadruplex appliance.

To Stephen Dudley Field belongs the honor of having developed a quadruplex circuit more highly sensitive to the cable currents, and which in a great measure diminishes the retarding effects due to the capacity of the cable. This result is attained by giving a sine-wave character to the working currents, and by the use of auxiliary electromagnets which tend to hold the neutral relay steady during the current reversals, and to accelerate its action at other times. It is believed that this improvement will be a boon to cable service.

Wireless Telegraphy and Telephony.

The development of wireless telegraphy and telephony in the United States for the past year has been confined to essentially commercial lines. No marked advances in theory have been announced except the general solution of the oscillation transformer problem, which has been reduced to a working form by Louis Cohen, and independently by John Stone, formerly of the Stone Telephone and Telegraph Company, of Boston, Mass. The general solution of this trying problem was found in 1906 by Stone and Roos, but was not reduced to a working form on account of the complexity of the resulting expressions.

There has been a marked tendency to follow German methods and practice in the absence of an adequate engineering manual of American practice, Zenneck's "Leitfaden in der Drahtlosen Telegraphie" being used by an increasing number of engineers. In spite of the "glossing" over of two different treatments of the subject in this work, the main results set forth are accurate enough for practical use.

There is still a wide-spread tendency among engineers to consider that stranding of fine insulated wires in large numbers is a gain under all circumstances for use in inductances and conductors carrying high-frequency current. This is by no means correct, as Heaviside has indicated. Stone and Roos have demonstrated before the Society of Wireless Telegraph Engineers the proper application of stranding for high-frequency work.

Increased use is being made of wavemeters. Frequent measurements for damping in stations where interference is serious are indicative of a movement in the near future to control not only the wave-length but the selectivity according to the "distance ratios" between operating and "interfering" stations. It is to be hoped that a Government commission may soon be appointed to decide upon this remedy, in spite of interests united against it.

There has been from time to time announcements of "inverted" systems of "Hertzian" telegraphy, in which the earth acts as a conductor for high-frequency currents *through* the bulk of its mass. This *modus operandi* would be subversive of the fundamental principles of the subject. In certain cases the Hertzian wave has been looked upon as parasitic, if not useless. It is hardly necessary to comment on this view: results when forthcoming will be the best guarantee of an attentive consideration of them by mathematically trained engineers.

In the line of apparatus the improvements are almost all mechanical. Expensive forms of foreign condensers have been slow to find a proper field, being used more for lightning protectors than for high-tension high-frequency work. The "condenser battle" of the future will be fought out on the lines of a compact plate condenser for high-power stations, and a cheap, substantial tube for low-power work.

Loose coupling as a factor for proper tuning, thanks to the labors of Stone, Fessenden and others, is universally recognized as a necessity in the receiving circuits. It is now easy to show on a majority of even amateur apparatus the relation between the "optimum" coupling and the maximum.

An intelligent treatment of hardwood and cardboard for use in high-frequency apparatus has permitted satisfactory results with a considerable reduction in cost. The problem of preventing oxidation of hard rubber in the presence of heat and moisture has yet to be chemically solved.

The development of a new line of hood-type strain insulators has at last standardized the method of avoiding antenna leakage, the "bug-bear" of all selective work in the art.

The advance made in producing continuous or quasi-continuous waves for telegraphy or telephony, has been in the main along structural lines. In another place the work of DeForest in the field is reviewed. Fessenden's work on the high-frequency dynamo developed by E. F. W. Alexanderson and others of the General Electric Company is too well known to be more than referred to here.

The foundation of a commercial use

in the United States of Max Wien's discovery in 1906 of "the quenched" spark has been laid by Dr. G. Seibt, formerly of the "Telefunken" company. Seibt's use in 1902 of a phenomenon similar to that subsequently observed by Wien promises an interesting patent situation in this country, but whatever the merits of the case there is no question that with the use of 480 cycles and a single quenched discharge at each alternation, the "quenched" spark becomes the "singing" spark, and is readable through its beautiful clear tone through any interference except the worst form of "rolling static." Even this disturbance has been eliminated by the use of a system of phase balancing invented by O. C. Roos, chief engineer of the Great Lakes Radio Telegraph Company. The efficiency of transformation of the "singing spark" is, under the worst conditions higher than that in "persistent spark" systems with their accompanying "mixed" damping and tuning. "Singing spark" units of five kilowatts capacity are being installed and there is evidently no superior limit to the output of a "singing spark" station except that fixed by the conditions which require complete dissipation of the heat above a certain critical point at which partial discharges occur and change the quality and pitch of the tone. The gap is the critical part of the system and its development is now almost completed for commercial use.

No radical improvement in generating high-frequency oscillations has transpired, as before noted, but the "noisy" characteristics of the DeForest and Collins oscillators have been reduced. Roos has advocated strongly for oscillator series-working an automatic constant-current system instead of the present constant-potential system which is fundamentally unstable and contradicts the whole of previous practice in commercial work at low-frequencies, where the stability is even relatively greater. This problem is being attacked in several quarters and should yield results in wireless telephony, at least equal to those obtained by foreign inventors who claim from 120 to 550 miles clear, telephonic communication.

Engineers are not generally agreed as to the relative merits of the "singing spark" and the oscillator. The tuning is practically equally sharp in both with present types of inductances, owing to the fact that as Fleming has shown the waves are not absolutely uninterrupted and the arc itself causes losses. The uses of the Poulsen "ticker" or DeForest receiving "chopper," with its inherent tendency to reduce the effectiveness of interference when an oscillator is used for transmission, and in addition, its direct use of the received energy renders it a desirable adjunct where spark stations interfere. In Toledo and Cleveland the stations of the Great Lakes Radio Telephone and Telegraph Company, which have been open for commercial work since August 25, show complete immunity from either static or the interference of neighboring stations wherever a wave-meter is used to ascertain the proper settings of the balanced "weeding-out" circuits invented by Roos. These circuits when used with the singing spark, however, without the "chopper" to receive are not as efficient as above since the intensity of received signals is cut down fifty per cent in some cases where eliminating interference.

A mechanical method of eliminating electrolysis, and uneven wear in oscillators, which has proven satisfactory in commercial work by tending to regulate for constant-current with series-oscillators has been suggested and developed by W. E. Laidley and O. C. Roos, and has been further improved by the latter, so that an almost perfect balance between capillary attraction and centrifugal force can be obtained.

In conclusion it may be said that four salient features of the year's work are significant.

Simplification of receiving apparatus, and subdivision into parts easily examined and repaired instead of the former practice of bringing all receiving elements of a circuit "under one roof."

Greater attention to efficiency of transmission and care of identifying "quality" of spark through interference for calling purposes.

Co-operation of telegraph and telephone in commercial stations by use of continuous oscillations for both methods.

Adoption of engineering methods by leading companies to replace mere "station building."

The teaching of wireless engineering by a thoroughly trained instructor, F. A. Kolster, formerly of the Stone Telephone and Telegraph Company, at the American Wireless Institute in Detroit has added a new impetus to popular appreciation of the art.

The chief obstacles in the development of wireless telegraphy at present are the facts that in most countries wireless telegraphy is a state monopoly, and until there is an amelioration of the antagonistic attitude of the cable and wireless interests progress will be delayed. It is understood that permits have been obtained in some of the South American and Central American countries and the present year will probably witness some active competition in that locality.

The adaptation of the Enithoven string galvanometer as an indicating instrument for commercial wireless telegraphy at high speed may be considered important. Poulsen's use of this instrument in combination with a detector of the solid rectifier type has enabled him to obtain an excellent photographic record of long-distance high-speed wireless signals.

As regards the financial situation, there has been practically no change. The credulity of the general public has been an incentive to the formation of companies interested only in the sales of stock.

The broadsides which have been directed against some of these companies has naturally resulted in making it difficult for reputable companies to do any large amount of business. It is hoped that this state of affairs will not continue much longer.

Electric Lighting and Illuminating Engineering.

Although there have been no radical departures in electric lighting and illuminating engineering during the past year, there has been marked and steady progress in improving electric light sources and in electrical illuminating methods. Both of these have resulted in the rapid extension of electric lighting along established lines and in its introduction into the formerly undisputed realm of its competitors.

A review of the improvements in

light sources might very well begin with the flaming arc lamp, which, on account of its great flux of light, has been found to meet very satisfactorily the requirements of a certain field of high-power illumination aside from merely spectacular lighting. On account of the relatively high cost of the carbons special attention has been directed to methods for decreasing the waste in their consumption and diminishing the cost of trimming by increasing the time between trims. A number of inventors have directed their attention to this problem with the result that several forms of magazine lamps holding several sets of carbons that are automatically burned in succession have been developed. A regenerative flame lamp has been perfected in which the life of the carbons is materially increased by an arrangement of draughts that compels the complete oxidation of the products of combusion.

The vertical-carbon type of flame lamp has come into extensive use where a fairly wide distribution is desired. The type of lamp with converging carbons is used in places where a high-power concentrated light is required. By mounting the latter lamps at a considerable distance above the plane of illumination they also give a good distribution. In iron foundries they are now frequently mounted at a height of about seventy-five feet, thus giving abundant clearance for traveling cranes. For the lighting of important streets flame arcs are rapidly coming into extended use in this country, as well as in Europe.

The magnetite arc lamp has also seen considerable extension of use, particularly for street lighting, for which this lamp is peculiarly adapted. Improvements have been made toward making the lamp operate more steadily. A larger number of sizes is now available so that they can replace any direct-current series arc. The whiteness of the light, the relatively long life of the electrodes, and the satisfactory manner in which these lamps run on constant current has made them very popular for series street lighting.

The titanium carbide arc lamp, which is an adaptation of the magnetite lamp for alternating circuits so as to eliminate the need of rectifiers, has received some attention and a number of circuits have been installed. High cost of the electrodes and the comparative unsteadiness of the arc have hindered their general introduction so that these lamps may be regarded as still in the experimental stage. However, when these difficulties are overcome it is believed that this type of lamp will be as successful in replacing the alternating-current inclosed series arc lamp as the magnetite lamp has been for displacing the old direct-current open arc lamp.

Outside of the development of a direct-current inclosed arc employing small carbons and giving a very white light of greatly increased efficiency and frequently spoken of as the intensified arc, there has been no marked change in the direct-current or alternating-current open or inclosed arc lamps. By many it is regarded that the decline of these types of arc lamps has set in on account of their rapid substitution by flaming arcs, magnetite arcs and even tungsten lamps.

The Westinghouse-Nernst system of lighting has extended its sphere of adaptability during the year by the development of what is called an instantaneous lighting unit. This type of Nernst lamp has a heater in the shape of a silicon filament which becomes incandescent at the instant that the current is switched on and therefore furnishes some light immediately before the Nernst glower proper has come into full play. This improvement has made the Nernst lamp serviceable for residence lighting in which it has been unsuccessful heretofore because the glower required nearly one minute to become fully incandescent. Further improvements in the Nernst efficiency and an increase in the variety of the units have enabled this type of lamp to remain an active competitor in the electric lighting field.

In the way of tube lighting both the Moore tube and Cooper Hewitt systems have been further developed. The auxiliary details of the yellow Moore tube, containing nitrogen, and of the white Moore tube and Cooper Hewitt systems have been improved. A compact form of the white tube, called an artificial daylight window, has been brought out for color-matching purposes.

The Cooper Hewitt mercury-vapor tubes have been improved as to both the electrical and mechanical features of their design. A larger proportion of automatically started lamps are now in service. Partly as the result of these facts the records of a very large number of installations show a decrease in maintenance for renewal of tubes of about fifteen per cent over last year. The cost of maintenance per kilowatt-hour is said to be less than one-half cent. A new type of automatic lamp, having two tubes side by side that can be placed in multiple for 110 volts or in series for 220 volts, has been brought out. The number of Cooper Hewitt installations in industrial plants has been increased very largely during the year. This is mainly due to the growing appreciation of the value of general illumination, and for this the Cooper Hewitt lamps have been found peculiarly suited because their high efficiency and complete light distribution permits them to be placed as near as possible in the same location and direction as the natural light enters by during day.

In the line of metallic filament lamps both the tantalum and tungsten lamps have been improved and adapted for still other kinds of service. As to the former the most marked improvement has been that which has adapted it for street-railway lighting. For direct-current traction systems they have been found to give very satisfactory results in both the sixteen and thirty-two candlepower sizes. This lamp can be burned at any angle, and if the filament should become broken it can be rewelded with a little skill so as to make the lamp again serviceable. These lamps are rated at 2.3 watts per candlepower.

A number of very important developments in tungsten lamps were made during the year. Among these were the production of a sign lamp taking five watts at about ten volts; further types of miniature and low-voltage lamps; improved and larger varieties of street series lamps; also both larger and smaller sizes of 110-volt multiple lamps. The series tungsten lamps are now made for currents up to 9.6 amperes, so that they can be substituted on any standard series arc circuit. It has been found that they can be used on circuits with frequencies as low as twenty-five cycles without perceptible flicker. The 110-volt lamps are now available in sizes from the new sixteen-candlepower type, which is the smallest, to the 200-candlepower type, temporarily the largest. Other types and sizes are being perfected.

Along with these new types there have been improvements in efficiency, life and toughness of the filament. In certain special miniature lamps the

efficiency has been brought to 0.9 watt per candlepower. The average useful life has been found to be well above the rated 1,350 hours for street series lamps and over the rated 800 hours for 110-volt multiple lamps. Breakage in shipment has been reduced to very small proportions, and breakage in service has been decidedly decreased as proper care of the lamps has become better known. Several types of shock absorber have contributed to this result also.

The alarm with which many central-station companies regarded the introduction of the tungsten lamp has been almost universally found to be unwarranted. Experience has shown that the diminished current consumption on the part of some consumers, who have availed themselves of the high efficiency lamps to reduce their lighting bills, has been offset by the demand from a large number of new consumers, who have been attracted to electric lighting by its diminished cost as well as inherent advantages. Large numbers of consumers have adopted the tungsten lamp not so much as a means of reducing lighting bills, but rather as a means of securing better illumination both as to quantity and quality. It is unquestionable that the tungsten lamp has come to be generally utilized to extend electric lighting into spheres where its foothold has hitherto not been very secure.

As a result of extended study of the subject of heterochromatic photometry, it has been proposed to use a tungsten lamp instead of a carbon incandescent lamp as a secondary standard in comparing light sources of different color.

That the study of the scientific and practical aspects of the problems associated with illumination is attracting worldwide interest is indicated by the formation in England of a sister organization to the Illuminating Engineering Society of America.

While the progress in electric lighting and illuminating engineering during 1909 was not startling, except as to its breadth and steadfast character, the indications are that 1910 will bring some radical developments both in electric light sources and illuminating methods.

The development of the metal filament lamp has been essentially a matter of laboratory research and technical refinement. Consequently the announcements made, to become effective January 1, 1910, of the new "Mazda" lamp, is of great interest and timeliness. Arrangements have been made whereby the technical staff of the research laboratory of the General Electric Company in collaboration with the technical staff of the National Electric Lamp Association and others, shall regularly follow the work done in the factories and laboratories of the leading foreign and American lamp companies, keeping constantly informed as to the progress and development in methods and processes in each. This information will be available to the lamp manufacturing companies enjoying the benefits of this arrangement. For the purpose of identifying the lamps made in accordance with the information thus secured, the research laboratory has adopted as a trade-mark the word "Mazda," this name on any metal filament lamp to indicate that the expert knowledge and skill of its technical staff entered into the production of that lamp, and that the best materials and processes known to it as fitted for that type of lamp have been employed in its manufacture.

Electric Railroading.

Among the notable developments for the past year has been the continued progress in the field of main-line railroad electrification. The dearly bought experience of the New York, New Haven & Hartford Railroad has shown fruits in the vastly improved methods of design and operation which have been effected in the working of that road, and it may safely be said that this 11,000-volt single-phase system is now an unqualified success. This is further evidenced by the fact that the directors of the road are pushing forward the extensions already under construction and are making plans for expansion in the immediate future.

An epoch-making event in electric railroading in the United States was the opening, early in June last, of the Cascade Mountain Tunnel of the Great Northern Railway in Washington. In this, the first three-phase installation on a trunk-line railroad in this country, the current is generated in a hydro-electric plant at 6,600 volts, twenty-five cycles; the 33,000-volt transmission system delivers energy to a substation; and the current is finally stepped down to 6,000 volts, at which pressure it is supplied to the overhead trolley wires. On the locomotives the pressure is reduced by three-phase transformers to 500 volts for operating the four three-phase motors with which each locomotive is equipped. This system was fully described by Dr. Cary T. Hutchinson in a paper presented at the two hundred and fortieth meeting of the American Institute of Electrical Engineers in New York, on November 12 last. The discussion on the paper brought out many interesting points, among which not the least interesting was a comparison between American and European practice in electric railroading.

New York city has been a center of much attraction during the past year by reason of the extraordinary developments which have been taking place in and around that great metropolis toward the solution of the local transportation problem. The twin tunnel tubes from Cortlandt Street, New York city, to Exchange Place, Jersey City, were officially opened on July 19 last, and the first official train was run through with great celebration. The Hudson and East River tunnels of the Pennsylvania Railroad were officially inspected by President McCrea and other officials on November 18 last, and it is said that the entire system will be opened to traffic by June 1, 1910. For the operation of these last-mentioned tubes there will be employed twenty-four electric locomotives, each weighing 330,000 pounds. Terminal facilities in New York have also been much improved, and in this connection special mention might be made of the three-level terminal at the Grand Central Depot, which is fast nearing completion.

In Chicago there has been much popular and newspaper agitation in the matter of terminal electrification as providing a more efficient method of handling the traffic problem and also with a view to the abolishment of the smoke nuisance. The controversy has centered chiefly about the Illinois Central Railroad, and while at one time it seemed likely that action was about to be taken in this particular instance, the

directors of the company at the last moment shelved the scheme for the time being. President Samuel Insull, of the Commonwealth Edison Company, has gone on record to the effect that his company has immediate facilities for providing power for the electrification of any two of the Chicago railroads, and it seems now to be only a question of the capital expenditure involved to the railroad companies, inasmuch as electrical engineers fully approve of the advisability of the proposed changes.

Throughout the country at large there has been a great expansion of the single-phase systems already in operation, and there have been many investigations for future extensions. In this connection it may be mentioned that railroad electrification has lost one of its greatest advocates by the death of that foremost of captains of railroad industry, E. H. Harriman, who passed away on September 9 last. Mr. Harriman, however, like all great executives, had chosen his lieutenants and laid his plans so wisely that his influence in the matter will be felt long after his death, and there is no doubt that many of his intentions will be carried into effect in the near future.

The new electric locomotives which have been developed during the past year call for a more than passing mention. Chief among these is perhaps the high-powered, fast-speed, articulated-truck, electric locomotive built for the Pennsylvania Railroad. This great machine has been described as the practical equivalent of two "American" type locomotives coupled permanently back to back, and the system of connection from the frame-mounted motors through countershafts to the driving wheels by a system of cranks and parallel connecting rods, is also very similar to steam-locomotive practice. The tractive effort is guaranteed at 60,000 pounds, and the speed, for heavy service, at sixty miles an hour, although a velocity of as high as seventy-two miles an hour has been developed on trial under service conditions. The weight is 332,100 pounds, of which a total of 208,000 pounds is carried by the drivers, and the motors develop 4,000 horsepower for a continuous heavy output.

Gasoline-electric motor cars have been further developed to a certain extent, and the Southern Railway Company has installed two of these on its system after a protracted and successful trial.

There has been the usual talk about instituting moving platforms and monorail systems, especially in New York city, but beyond the granting of a franchise to Mr. Baehr for a monorail system in Manhattan, nothing further has developed in this connection, and no practical work has yet been attempted.

One of the greatest events in the electric street-railway world was the holding of the mammoth conventions at Denver. Among the problems discussed were the advisability of co-ordination with the steam-railroad associations with a view to standardizing the methods of operation of railways of all kinds, and the necessity for the standardization of street-railway equipment. The experience of the Brooklyn Rapid Transit Company, which has done some excellent pioneer work in this line, was detailed at some length by one of the officials of that company, for the benefit of the assembled delegates.

A noticeable feature of the year has been the adoption by many cities of the pay-as-you-enter type of street car, Chicago alone having put in operation more than 1,000 of these cars. It is a question, however, whether or not the limit of size has been reached, or even exceeded, in the latest designs, and many accidents have occurred, especially in Chicago, where the clearance between passing cars has been too small, necessitating either a reduction in the size of the cars or an increase in the distance between the centers of the up and down tracks.

In the field of motor construction for street railways the claims for the interpole motor appear to have been fully realized, and the brushes which have been developed for these machines have proved very satisfactory, having a life of from 100,000 to 150,000 miles. The solid-frame motor seems to be coming more and more into general favor, and the single-phase system has proved to be most efficient in operation.

During the year considerable agitation has occurred for the use of a stronger illumination in the cars, as a result of which the New York Service Commission has ordered the railway companies in New York to install units of higher candlepower throughout their systems.

Telephone train-dispatching systems have been developed and installed to a considerable extent throughout the country, and among the electric roads which have adopted this efficient and up-to-date method of regulating their traffic may be mentioned the Syracuse, Lake Shore & Northern, and the Syracuse & South Bay roads, both of which are controlled from a single telephone train-dispatching office located at Syracuse.

Electrochemistry and Electrometallurgy.

The year 1909 has been remarkable for the industrial application and expansion of electrochemical and electrometallurgical processes. It would be impossible to name another industry or group of industries in which the percentage increases have been so enormous. What were but a short while ago laboratory experiments have now grown into huge commercial enterprises in which capital is being sunk not as wildcat speculation but as paying businesslike propositions.

Some of the many enterprises which may be instanced are: The manufacture of cyanamide and other artificial fertilizers; the electric refining of steel; the production of pig iron in the electric furnace; electrolytic bleaching; electrolytic detinning of iron scrap; and the manufacture of silundum;—while the manufacture of carborundum, calcium carbide, artificial graphite, aluminum, and other products, by means of the electric furnace, which were already well established over a year ago, have been developed in a degree comparable with the growth of the newer industries.

To name a few specific examples:—The United States Steel Corporation has adopted the Héroult furnace for steel refining, one furnace at the South Chicago Works of the Illinois Steel Company, and one at the Washburn & Moen plant at Worcester, of the American Steel and Wire Company. Each furnace has a capacity of fifteen tons, the steel being intended especially for rails and wire, with a probability of also using it in the near future for the manufacture of tubes and other products. Up to the establishment of these furnaces the largest Héroult furnace in operation had a

capacity of but five tons, and the largest electric furnace of any kind, a Röchling-Rodenhauser in Germany, a capacity of eight tons.

The Aktiebolaget Electrometall, of Ludvika, Sweden, has erected, in Norway, the first electric smelting plant in the world for the production of pig iron on a commercial scale. This includes two 2,500-horsepower induction furnaces for the direct smelting of iron ore, and two 600-horsepower steel-refining furnaces, and there are more to follow.

For the manufacture of artificial nitrates and similar products electrically from the air, several millions of dollars have already been invested in large hydroelectric plants in Norway, at Notodden and Svalgfos, and at the rivers Rjuken and Vamma. It is expected that these plants will be completed by the end of 1910, at a total cost of $15,000,000.

The Goldschmidt Works at Essen, in Germany, has established electrolytic detinning on a commercial scale, the product of the electrolytic bath being a spongy cathodic tin about ninety-eight per cent pure, containing some lead as an impurity. Further experimentation is being carried out in this connection.

The above list might be greatly enlarged, but enough has been adduced to show the remarkable developments which are taking place.

Several noteworthy conventions in electrochemistry have been held during the past year. Chief among these was the Niagara Falls convention, in May, of the American Electrochemical Society. This was truly an international gathering, as many celebrities in the world of electrochemistry were present, and, by their papers and discussions, contributed largely to the success of the meeting. The electric furnace was very fully discussed in all its phases at this convention. Among some notable papers presented at this convention may be mentioned Dr. L. H. Baekeland's exposition on "bakelite," which was described, in its final stage of manufacture, as a "polymerized compound anhydride of a phenol-alcohol and methylenglycol," and which the author had previously announced at the February meeting in New York of the American Chemical Society. This bakelite is a hard structureless mass, resistant to boiling water, steam, and almost all chemical solvents, tasteless, odorless, and an excellent insulator of heat and electricity.

Doctor Schoenherr described the new process of the Badische Anilin und Soda Fabrik, in Ludwigshafen, Germany.

Major Sfassano, of Italy, described the electric furnace of his invention that bears his name.

Dr. F. A. Kjellin presented a paper on the development of the Kjellin and the Röchling-Rodenhauser furnaces.

Among other notable conventions were the International Congress of Applied Chemistry in London, which opened in May and lasted for two weeks, and the New York meeting of the American Electrochemical Society at the end of October. A feature of this latter convention was the prominence given to the subject of electrode losses in electric furnaces, two notable papers being presented by Dr. Carl Hering, and one each by C. A. Hansen and Dr. E. F. Roeber. Another noteworthy paper at this meeting was one by W. L. Spaulding on "Power for Electrolytic Copper Refining," in which the author gave some valuable suggestions showing how central stations could build up a profitable electrochemical load for their off-peak hours, thus increasing the load factor and the overall percentage returns on the total investment.

A new field for investigation has been opened up by the researches of Professor Burgess and his associates at the University of Wisconsin, undertaken partly with the help of the Carnegie Institution, on the production by a practical method of a very pure, carbon-free iron by electrolytic refining. The mechanical, electrical and magnetic properties of non-carbon steels, made from this iron, have been extensively studied and it is predicted that such steels will find very many uses in a large number of industries.

The new resistance material, silundum, the discovery of F. Bölling, has been the subject of many papers and researches, and is already being used on a commercial scale in the manufacture of electric heating and cooking appliances, etc.

Prime Movers and Batteries.

Except in the case of the gas engine, there has been little change in the standards which have been recognized in prime mover construction during the year. The excellent steam consumption records which were secured with reciprocating engines several years ago, has remained almost standard, with refinements in design, looking to the improvement of stability in the wearing parts, and the better distribution of auxiliary apparatus in order to economize space. Much progress has been made in the development of high-speed gas engines in the larger sizes and in the building of gas engines for operation on blast furnace and producer gas. Gas engines of the smaller sizes have been made in greatly increased numbers, and there has also been a great increase in the output of both simple and compound high-speed engines for comparatively low capacities.

Low-pressure turbines have been operated very successfully in a number of installations, and the demand for these machines to work in connection with the exhaust end of non-condensing reciprocating engines has been greatly increased.

Possibly the largest increase in demand along any one line has been the call for turbo-alternators. With one company the sales of this type of apparatus have increased practically four fold over those of last year. These have varied in size from 300 kilowatts to 500 kilowatts, the 500 kilowatt having the largest sale of any one size. While most of the turbines have been intended to be used condensing, there have been many calls for non-condensing turbines.

Another field that has seen greatly increased activity during the past year is that of low-head waterpower development. The greater number of low-head than high-head waterpower sites has brought this class of machinery prominently into view. With our present types of hydraulic machinery, heads as low as seven feet are successfully developed. The size of the low-head units run as high as 4,000 kilowatts.

Concerning storage batteries there has been a continued development in

methods of manufacturing and processing, whereby the mechanical strains of the grid type are more easily sustained, and the surface of active material considerably increased without impairing the rigidity of the gird structure. Improvements have also been made in the containing cells and in the methods of establishing connections. There have been a number of very successful installations of storage battery booster systems in connection with alternating-current generators, and some very large installations of the nature of standby equipments for railway, light and power service.

Probably in no direction has there been so great an increase as in the use of storage batteries for vehicle propulsion. The active campaign made by one of the large manufacturers of storage batteries in bringing to the attention of central stations the advisability of charging storage batteries as a means of increasing central station revenue, together with increasing the interest of the electric vehicle manufacturer in the central station problem, has resulted in a greatly increased appreciation of the merits of the modern electric wagon. There has also been a great increase in the use of electric trucks for delivery service of every character, this in turn greatly increasing the demand for vehicle storage batteries.

General Survey and Manufacturing Statistics.

During the year there were a number of notable meetings of engineering, scientific and commercial societies. The American Institute of Electrical Engineers held a most enjoyable convention at Frontenac, in the Thousand Islands, New York, in mid-summer, when a series of important papers was presented and discussed. Two features of this convention stand out prominently. One was the great attention given to the subject of the rapid adoption of the electric drive in steel mills, and the remarkable success which was being accomplished in this direction. The other was the discussion of the introduction of that character of instruction in our engineering colleges as would call for an extremely high intellectual training and development. At the Atlantic City convention of the National Electric Light Association, a number of valuable papers were read with the introduction of several sessions devoted to central station accounting. In connection with this convention there was a notable attendance of men prominently identified with the leading financial interests of the country, their presence and discussions indicating the leading place that electrical securities were taking as stable forms of investment. The District Steam Heating Association, formed during the year, recently held a very profitable convention.

The National Physical Laboratory of Great Britain made an important announcement last May, relating to the establishment of an international candle photometric unit. In order to come into agreement with Great Britain and France the Bureau of Stands of America proposed to reduce its standard candle by 1.6 per cent, provided that France and Great Britain would unite with America in maintaining the common value constant and with the approval of other countries would call it the International Candle. The National Physical Laboratory of London and the Laboratorie Centrale d'Electricite of Paris agreed to adopt this proposal, and the date agreed upon for the adoption of the common unit and change of unit in America was April 1, 1909. The following simple relations, therefore, hold after that date: Proposed new unit = 1 pentane candle = 1 bougie decimale = 1 American candle = 1.11 Hefner unit = 0.104 Carcel unit.

In general physics a conspicuous item was the liquefaction of helium by Onnes. There has been a good deal of work of cumulative importance in radio-activity, which is improving our knowledge of molecular physics. The work of Rutherford and others in counting the alpha particles and showing that they constitute helium is noteworthy. Hale's work on solar vortices and magnetic fields is the most important in astrophysics. The last steps in experimental demonstration in the electromagnetic theory of light have been carried out by Poynting and Barlow, showing that a source of light experiences pressure on account of its radiation.

Early in the year there appeared to be evident a very determined attitude upon the part of the Federal Government to investigate the relation between the water power companies and several of the large electrical manufacturing concerns. There was also some agitation concerning an investigation of the possibility of trust agreements in connection with these interests. President Roosevelt, in his promulgation of ideas concerning the conservation of energy, asked for an appropriation of $50,000 to carry out the recommendations of a National Conservation Commission, looking to the protection of water power resources, and the establishing of regulation by legislative enactment. During the latter part of his administration, however, this matter was allowed to rest, and the early part of Mr. Taft's administration has apparently allowed the matter to lapse. The subject has been brought up again, however, and there is a possibility now of the matter being discussed very fully, due to the imbroglio which has come about in connection with some land grants disposed of by the department of the Secretary of the Interior in conflict with the ideas of the Forestry Department.

In manufacturing there has been a very satisfactory development, with a great improvement in business. While a careful survey of the field does not seem to indicate that 1909 has reached the proportions in the way of business done of 1906, it is considerably better than 1908, and more than equal to that of 1907. The greatly increased demand during the last six months for turbo-alternators, for engine-driven generators, of increased activity of water power development, the refinancing and new developments in electric railroading, has brought the electrical industry almost to the conditions of boom-time prosperity, and indicates for 1910 a season of great activity.

There has been an increasing use of electrical drive in all sorts of manufacturing establishments. Practically every textile mill that is now designed is arranged for the electrical operation of the machines, either singly or in groups. In all of the larger cement mills built during the past year, none but has been equipped entirely with

electric drive. Of many saw mills, several of those built during the past year have been entirely equipped with motor drives.

Motor-generator sets of large capacity are coming more generally into use, as designers are perfecting them and users are discovering their adaptability to various conditions. In the motor-generator field there has been a very interesting development in the fly-wheel generator. The year has set but little advance in transmission voltages, beyond the 110,000 volt line of the Grand Rapids-Muskegon Power Company. This was inaugurated in July, 1908. However, two other large generating and transmission systems have gone into service, these being the Southern Power Company at Charlotte, N. C., and the Hydroelectric Commission, of Ontario, Canada. The year's progress in high-tension transmission has been toward the end of accurate control of standard working voltages, and the development of adequate switching and protective apparatus for these extremely high voltage limits.

The past year has seen the development and practical operation of the first circuit-breaker or switching apparatus for breaking 110,000-volt circuits, using the condenser type terminal. Electrolytic lightning arresters of improved design are now available for 110,000 volts. Twelve 1,000-kilovolt-ampere units of the 100,000-volt type transformers have been furnished the Southern Power Company. There has also been an increase in the capacity of motors adapting them for heavy duty in steel mill work.

In the accompanying table there are given figures estimating the approximate value of the manufactures of electrical and kindred apparatus turned out during the past year. These figures have been compiled from data supplied by the leading manufacturers and engineers interested in these products, and we take this opportunity of thanking very cordially those who have cooperated with us in the development of these statistics.

ESTIMATE OF THE VALUE OF ELECTRICAL AND AUXILIARY MANUFACTURES IN THE UNITED STATES.

Articles.	For the Year— 1905.	1906.	1907.	1908.	1909.
Arc lamps and appurtenances	$ 2,600,000	$ 3,225,000	$ 3,150,000	$ 2,000,000	$ $2,500,000
Auxiliary steam plant for electrical installations, such as pumps, condensers, separators, feed water heaters, injectors, piping, etc.	2,725,000	3,275,000	3,100,000	2,000,000	3,000,000
Bells, buzzers, push-buttons, call-boxes, annunciators	1,000,000	1,250,000	1,300,000	1,300,000	1,500,000
Belting used in electrical plants	550,000	450,000	425,000	200,000	200,000
Boilers for electrical plants (water-tube)	6,750,000	7,500,000	6,000,000	4,000,000	5,000,000
Boilers for electrical plants (other than water-tube)	2,850,000	2,750,000	2,500,000	1,500,000	1,750,000
Cables, underground, aerial and submarine	17,750,000	22,000,000	18,000,000	10,000,000	11,000,000
Carbons for lamps, batteries, brushes or other electrical purposes	3,000,000	3,500,000	3,500,000	2,250,000	4,000,000
Cars and trucks for electric railways	8,000,000	11,750,000	8,650,000	6,900,000	7,500,000
Castings, copper, and other metals, used by electrical manufacturers	.....	.....	.....	300,000	500,000
Circuit-breakers	1,450,000	1,700,000	1,675,000	920,000	1,200,000
Conduits (underground) and similar material	3,300,000	2,900,000	1,700,000	500,000	700,000
Conveyors, coal and ash, used in electrical plants	900,000	900,000	775,000	400,000	425,000
Cranes and hoists, electrically operated	5,250,000	6,750,000	5,850,000	3,500,000	4,500,000
Dynamos and motors, including parts of machines, boosters, balancers, rotary converters, motor-generators, etc., and all motor applications, such as in automobiles, not specifically enumerated in this list	60,000,000	74,000,000	62,500,000	50,000,000	70,000,000
Electroplating and other electrolytic apparatus not elsewhere specified	800,000	1,000,000	1,000,000	1,000,000	1,100,000
Electrostatic machines, induction coils, medical sets, etc.	575,000	550,000	500,000	500,000	600,000
Elevators, electric (mechanism only)	4,350,000	5,500,000	4,675,000	1,600,000	2,000,000
Engines, gas, gasoline or oil, used to drive electrical machinery	2,500,000	3,500,000	4,300,000	6,000,000	9,000,000
Engines, steam (reciprocating), used to drive electrical machinery	13,350,000	13,500,000	12,000,000	9,000,000	12,000,000
Fans, electrically operated and direct-connected	1,375,000	1,575,000	1,850,000	1,100,000	1,500,000
Fire-alarm apparatus, also burglar alarms, crossing indicators, etc.	1,400,000	1,850,000	1,850,000	900,000	1,000,000
Fixtures for electric lighting	4,750,000	5,300,000	7,500,000	8,000,000	10,000,000
Fuses	650,000	900,000	1,200,000	750,000	1,000,000
Glassware, electrical	700,000	900,000	1,450,000	2,000,000	2,500,000
Heating and cooking apparatus, electrical	650,000	850,000	1,100,000	1,000,000	1,500,000
Incandescent lamps (carbon or metallic filaments)	6,625,000	8,600,000	10,000,000	11,000,000	14,000,000
Instruments for measurement and meters of all kinds; also ground detectors, scientific and laboratory apparatus, photometers, Leyden jars, X-ray outfits, etc.	4,200,000	5,000,000	5,000,000	2,000,000	2,250,000
Insulating material, fiber, tape, etc.	1,800,000	2,300,000	2,850,000	1,700,000	2,500,000
Insulators (glass and porcelain)	1,700,000	2,100,000	2,000,000	1,350,000	2,300,000
Interior wiring supplies, as tubing, interior conduit, molding, junction boxes, rosettes, outlet boxes, etc.	2,250,000	3,000,000	3,500,000	2,220,000	3,000,000
Lightning arresters	500,000	525,000	500,000	275,000	400,000
Mercury-vapor lamps	125,000	350,000	450,000	300,000	500,000
Nernst lamps	880,000	950,000	950,000	1,000,000	1,000,000
Poles and wire towers, cross-arms, brackets and pins	5,400,000	7,500,000	5,125,000	3,500,000	4,000,000
Primary batteries	1,200,000	1,825,000	1,800,000	1,000,000	2,000,000
Railway supplies, electric, such as trolleys and other contact devices, strain insulators, cross-overs, rail-bonds, etc.	2,200,000	3,000,000	4,000,000	2,200,000	3,000,000
Rheostats, car controllers, motor starters, etc.	3,250,000	4,600,000	4,750,000	2,600,000	4,700,000
Shafting, pulleys, clutches, etc., used in electrical generating plants	750,000	800,000	725,000	400,000	500,000
Signs, electric	.....	.....	.....	1,000,000	1,250,000
Sockets, switches, cutouts	4,150,000	5,500,000	5,500,000	4,000,000	5,000,000
Steam turbines used to drive electrical machinery	4,000,000	8,000,000	8,000,000	7,000,000	12,000,000
Storage batteries, including those used in automobiles	6,200,000	6,950,000	6,200,000	5,500,000	6,600,000
Telegraph instruments and apparatus	300,000	375,000	475,000	400,000	600,000
Telephones, telephone switchboards and distinctively telephonic apparatus	19,200,000	28,500,000	21,000,000	15,000,000	15,000,000
Third rail for electric railways	750,000	950,000	750,000	.....	1,000,000
Transformers, stationary	5,175,000	6,850,000	5,500,000	3,025,000	4,000,000
Waterwheels, used to drive electrical machinery	1,700,000	2,750,000	3,100,000	3,000,000	4,000,000
Welding apparatus, electric	95,000	110,000	120,000	.....	150,000
Wire, bare	20,000,000	33,000,000	27,000,000	18,000,000	22,000,000
Wire, rubber-covered	11,000,000	14,000,000	16,500,000	11,000,000	12,000,000
Wire, weatherproof	9,500,000	15,000,000	15,000,000	9,000,000	10,000,000
Wire, all other electrical	3,500,000	4,625,000	4,150,000	4,000,000	5,000,000
Wireless apparatus	400,000	475,000	425,000	500,000	500,000
Miscellaneous, including switchboard frames and panels, signs and flashers, automatic stokers for electrical plants, wire guards, electrical tools and toys, projectors, solenoids, igniters for gas engines, waterwheel governors for hydroelectric plants, voltage regulators, electric drills, commutator compounds, lamp adjusters, shade holders, etc.	4,000,000	6,000,000	4,000,000	.....	10,000,000
Total	$268,075,000	$351,010,000	$315,920,000	$228,590,000	$304,225,000

Recapitulating into several groups the figures given in this table we are able to present in the following brief summary the comparative value of the electrical output during the past two years:

	1909	1908
Wires and cables	$ 60,000,000	$ 52,000,000
Dynamos and motors	70,000,000	50,000,000
Prime movers	33,000,000	15,000,000
Telephone apparatus	15,000,000	15,000,000
Lamps of all kinds	16,500,000	14,300,000
Cars and trucks and railway supplies	11,400,000	9,100,000
Boilers and auxiliary steam plant	9,750,000	7,500,000
Batteries, primary and secondary	8,600,000	6,500,000
Poles, etc.	4,000,000	3,500,000
All other	75,975,000	55,690,000
Total	$304,225,000	$228,590,000

LOW-VOLTAGE TUNGSTEN LAMPS FOR SIGN AND DECORATIVE WORK.

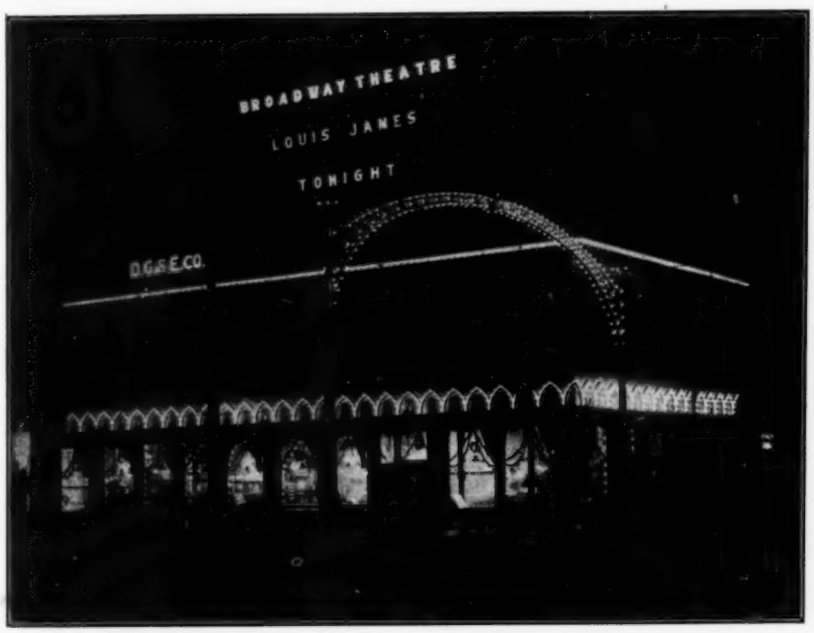
BY G. S. MERRILL.

Electric signs and decorative lighting present great and well recognized possibilities in the way of attracting the attention of the general public. The fame of the "Great White Way" is due for a very considerable part to the myriad of electric signs which look upon it from all sides. In every city, the prosperous retail business and theater districts present today a most varied and ingenious display of electric signs and other illuminated advertising devices. In addition to the usual electric sign the use of incandescent lighting to obtain decorative effects by outlining buildings or parts of them is growing rapidly and constitutes a very effective method of securing attention which in the end is the object of all true advertising display.

Sign and decorative lighting is very desirable from the central-station standpoint. It provides a definite and fairly steady load for about six hours of each twenty-four. The only disadvantage of such a load is that it falls upon the peak station load at just the time of the year that the generating equipment is most heavily taxed.

Since the larger part of sign and decorative lighting is carried on a flat rate basis or fixed charge per month, a reduction in capacity and energy required to serve such lighting without a corresponding reduction in income should be welcomed by the central station, especially if at the same time the customers secure a brighter, whiter, and better light. In many cases the monthly bill for sign lighting includes the care and maintenance of the sign as well as the cost of electrical service, thus relieving the consumer of any trouble in connection with this lighting.

The possibilities of increasing the general effectiveness of display lighting and at the same time reducing its cost by the use of the high efficiency tungsten sign lamp in place of the old carbon type is worthy of careful consideration.



OFFICE BUILDING OF THE DENVER GAS AND ELECTRIC COMPANY.

Cornice and arches outlined with tungsten sign lamps. This installation of 600 tungsten sign lamps was made in March, 1909. Eight¼-kilowatt transformers and two 1/3-kilowatt transformers were used in order to reduce the regular lighting circuit voltage to that of the small lamps. Seven transformers were mounted between the arches on the face of the building. Three were installed on the roof to supply the cornice lighting. The circuits are controlled from the primary side, eliminating all day transformer losses.

In order to utilize the high efficiency lamp for decorative and sign lighting with the greatest economy it has been necessary to adopt a rather low voltage as standard for such work so that a lamp could be produced which would compare in candlepower with the usual carbon sign lamp and which would consume considerably less energy. The tungsten sign lamp can be obtained for service on ten, eleven or twelve volts, consumes five watts, gives three and three-fourths candlepower with a life of 2,000 hours. It is made in the same size bulb as the small four-candlepower carbon sign lamp.

The tungsten sign lamp possesses several distinct advantages over the carbon lamp, which has served so long and faithfully, albeit inefficiently. The intrinsic brilliancy of the tungsten lamp is much greater than that of the carbon and is maintained exceptionally well throughout its life. This is a great advantage in display lighting where brilliancy or quality counts for more than candlepower or quantity.

The candlepower of a carbon lamp will decrease until the lamp burns out, at which time it may have dropped to sixty or even fifty per cent of its initial value. This decrease in candlepower is undesirable but is not as objectionable as the change in the color of the light from yellow to dull red as the lamp becomes old. Nothing detracts more from the effectiveness of decorative lighting than the motley or spotted appearance which results from lack of attention in replacing carbon lamps as they become dim. The use of the tungsten lamp is a good insurance against trouble of this nature since the candlepower of the tungsten lamp drops only ten or fifteen per cent during its life of 2,000 hours, and the quality of its light, and its brilliancy are very uniform throughout its entire period of service.

The use of the high-efficiency lamps in decorative lighting decreases not only the amount of energy required by this class of service but reduces the maximum demand on the station as well, at the time of the yearly peak. It is hardly possible to give any figures on the exact amount of the reduction in expense chargeable to this class of service by replacing carbon lamps with tungsten, but, the saving would well pay for the slight additional expense required to rewire the old sign in order to make the use of the tungsten lamps possible. Since the tungsten sign lamps operate on from ten to twelve volts it is necessary to modify the existing wiring of signs using higher voltage lamps. If the sign is served by direct current a series-multiple arrangement of the small lamps can be used on the present lighting circuit. If the sign is operated on alternating current either a series-multiple arrangement on the present lighting voltage or multiple arrangement in connection with a low-voltage transformer can be employed. The low-voltage transformer is recommended for use

where possible because it involves less change in existing sign wiring, and because the multiple arrangement is somewhat better from the standpoint of lamp performance. Sign-lamp transformers can be obtained in many convenient sizes, carrying twenty-five lamps or more. The efficiencies will range from ninety to ninety-five per cent according to the size. The regulation is fairly good but is not important unless the sign is flashed so that the load is not constant.

The tungsten lamps consume only one-fourth as much energy as the corresponding carbon sign lamps at about one-tenth the voltage or the amperage will be about two and one-half times as great as the carbon lamp. This makes it advisable to design or arrange the wiring so that the voltage drop will be small and thus assure more uniform and satisfactory service. In series-multiple work it is well to make the leads to the sign, and between the multiple groups rather heavy. If transformers are used, with a compact sign, one large transformer may be installed as close to the sign as possible and heavy leads run to various parts so as to form a network distribution over the sign. If the sign or lighting is extended over a considerable distance (as in outlining a building) it may be more economical to install several small transformers located at different centers of distribution. The main distribution is therefore made at the regular voltage of the lighting circuit with a less loss for a given size copper, and the secondary or low-voltage distribution, covering a more limited area can be made more efficiently than if it be attempted to serve the total load at the low voltage. Such details must be worked out for each particular case, taking into account the distribution of load, length of circuits, size of wire used in the sign circuits, etc. The matter is not difficult to adjust, however, and there are doubtless but few cases where the prospect of changing over need cause any trouble. There is everything to be gained by such a change and were it not for the rearrangement in wiring necessitated the carbon sign lamps would now be obsolete. As it is, the tungsten lamps are coming into use gradualy but none the less surely and the knowledge of the general satisfaction which they are actually giving is rapidly removing any doubts as to whether or not the advantages to be gained will warrant their installation.

Chicago South Side Surface Traction Systems Consolidated

The long talked of consolidation of all of the Chicago traction systems has been brought much nearer to realization by the consolidation of the South Side surface lines of that city. Announcement was made on December 27 that an agreement had been entered into whereby ninety-five per cent of the shares of the Chicago City Railway Company, all of the shares of the Calumet & South Chicago Railway Company, all of the shares of the Southern Street Railway Company, and all of the shares of the Hammond, Whiting & East Chicago Electric Railway Company have been taken over by Chicago financial interests.

The three former of these companies operate within the city limits on the South Side. The last of the companies operates in the state of Indiana, connecting the three cities which are included in its name with Chicago at the joint city and state boundary line. The name of the new company will be the Chicago City and Connecting Railways Company.

The consolidation was brought about chiefly through the agency of Ira M. Cobe, vice president of the Assets Realization Company. Associated with him were James B. Forgan, president of the First National Bank, John A. Spoor, president of the Union Stock Yards and Transit Company, E. K. Boisot, vice-president of the First Trust and Savings Bank, John J. Mitchell, president of the Illinois Trust and Savings Bank, Edward Morris, vice president of Morris & Company, T. E. Mitten, president of the Chicago City Railway Company and Samuel Insull, president of the Commonwealth Edison Company. These men are prominently connected with Chicago enterprises. The deal was concluded through the sale by J. P. Morgan & Company of New York of the controlling interest possessed by them in the Chicago City Railway.

The Chicago City Railway Company has outstanding $18,000,000 in stock and $20,000,000 in bonds; the Southern Street Railway, $800,000 stock and $775,000 bonds; the Calumet & South Chicago Railway, $5,000,000 stock and $5,650,000 bonds; the Hammond, Whiting & East Chicago Railway has $510,000 stock. The total par valuation of the securities of these companies is thus $50,735,000. The stock of the Chicago City Railway, however, is quoted at 191, thus bringing the total value of the securities to nearly $70,000,000.

The total mileage of the four companies is 410.51. The number of passengers carried by the combined system is about 318,000,000 per annum. The financing of the new company will be carried out by the issuance of $15,000,000 common stock, $25,000,000 preferred and $22,000,000 five per cent first lien bonds, making a total capitalization of $62,000,000.

The significance of this consolidation is that it shows a determination of Chicago interests to handle the traction situation themselves without the aid of outside financiers. It is believed that this one feature alone will aid materially in the further consolidation movement which it is expected will take in the Chicago Railways Company operating on the North and West Sides of the city and the reorganized Consolidated Traction Company operating in the outskirts and suburbs adjoining the Chicago Railways system. The reorganization of the latter company into the United Railways Company is well under way and it is stated that this company will apply to the City Council for a new ordinance covering the lines of the Consolidated Traction Company in a similar manner to the rehabilitation ordinances secured by the Chicago City Railway Company and the Chicago Railways Company in 1907, and the Calumet & South Chicago Railway Company in 1908.

This general consolidation of all the surface, and possibly also the elevated railway lines of the city has been looked forward to by all interests concerned, including the municipal government, as a step very much desired. It will mean unified management and operation and will permit the much desired running of through routes of which twenty-three have already been laid out across the city. The probability of taking in the elevated railway systems in the immediate future is not so great. The interest of the Commonwealth Edison Company in the consolidation is that merely of a power-producing company. It is believed that ultimately the power for the entire surface lines, at least, will be purchased from this company, which already supplies a large share of the power now used on both the surface and elevated systems in Chicago.

The Outlook for 1910.

Just before the close of the year an opinion was requested from a number of leading men in the electrical industry concerning the "Outlook for 1910." We are pleased to publish the following paragraphs. In each will be found a healthy expression of cheerfulness and optimism that augurs well for the maintenance of our present business activity:

CHICAGO TELEPHONE COMPANY.

"The business of the Chicago Telephone Company for the year showed a satisfactory increase, 30,500 telephones being added, compared with 28,500 for the previous year.

"The expenditures of the company for additions to plant amounted to about $4,000,000, and an amount somewhat in excess of that is appropriated for 1910.

"A new exchange at Lawndale has been built, and will be in service about June 1 next. This is a fireproof, three-story building, with plenty of room for growth for the next fifteen years.

"Property has been bought and the contract let for the new 'Wabash' exchange. The present expenditure is $500,000. While the present building will be seven stories, foundations are being put in for fifteen stories.

"The achievements of the electrical companies, both utility and manufacturing, for the year have been most gratifying, and the outlook for a further increase in business during 1910 is especially good.

"BERNARD E. SUNNY, President."

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY.

"The gradual improvement in business, which began about January of this year, has continued with reasonable steadiness all through the year, and hence the belief is warranted that the improvement has not only come to stay, but will continue until business is as good as it was prior to the panic in 1907. A most noticeable feature in the situation to me is the fact that the note of pessimism, which a year ago was still very pronounced, has absolutely disappeared. Everybody is cheerful and while, perhaps, very few concerns are as yet working to their full capacity, nearly everybody is doing good business, so that anxiety has been relieved and everyone is confident that the near future will show an entirely satisfactory condition of prosperity.

"W. M. MCFARLAND,
"Acting Vice-President."

WESTERN ELECTRIC COMPANY.

"Business conditions are most promising. The crops have been satisfactory, railroad earnings largely improved, and industrial plants are either getting ready or have prepared for a larger volume of business for 1910, which will make them larger consumers of motors and electrical supplies and apparatus in the coming year. The stimulus of this business was felt to some extent in 1909, and it is expected will continue throughout the coming year.

"Central stations and telephone companies are also feeling the results of improved business and are spending more, not only for the maintenance and up-keep of their plants, but for improvements and extensions.

"We are looking forward to 1910 for a continuance of the steady improvement that we have felt during this year.

"GERARD SWOPE,
"General Sales Manager."

NEW YORK EDISON COMPANY.

"Since the appearance of your articles of last year, financial confidence seems to have been restored and industrial revival is indicated from every direction. Nineteen ten promises to be notable and should it prove a record year in American industry and commerce would not be in the least surprising.

"That the electrical industry has been able to hold its own and make marked advance during the recent years of panic and depression cannot be other than gratifying to all. Electric light and power and the manifold uses of electricity found on every hand are now to be numbered amongst the necessities and not the luxuries of the American people.

"While the New Year will undoubtedly find marked prosperity in every branch of the electrical industry, the notable improvement will doubtless be in the increased use of metallic filament lamps—tungsten and tantalum. These appliances give the public more than twice the light for the same money or they are in effect the means of reducing the cost of electricity one-half. The co-operation of the supplying companies in placing these lamps at the disposal of their consumers, regardless of their own immediate interests, has undoubtedly made a most favorable impression upon the public.

"ARTHUR WILLIAMS,
"General Inspector."

NATIONAL CARBON COMPANY.

"I do not think there is any question but what the coming year will surpass any single year the electrical industry has ever witnessed. In fact, I am strongly of the belief that the next four years will break all records in all allied electrical industrial lines.

"N. C. COTABISH, "Sales Manager."

EDISON ELECTRIC ILLUMINATING COMPANY OF BROOKLYN.

"I am glad to be able to say that I believe the business outlook for 1910 is most encouraging. We find a very decided disposition on the part of business men to spend money in development work where profitable returns are promised, and the amount of new business in both the lighting and power field, now being secured from month to month, exceeds by a very large percentage the best previous records of our company.

"In a recent trip, which included a number of large cities in different parts of the country, I found the same encouraging conditions in all the cities visited, and I believe that the business outlook for 1910 is of the best.

"W. W. FREEMAN, Vice-President."

CENTRAL ELECTRIC COMPANY.

"It would seem amusing to refer to the present age of the electrical industry as infantile, as among the sayings of those who have written on the subject of electrical development to speak of the industry as in its infancy is a common practice, and yet I presume that at no time in the past since the real power of electricity under proper control has been recognized has its future appeared to me to admit of so much expansion.

"When one reflects on the vast inroads that have been made in the course of our industrial activities on the natural resources of the country, and considers the estimates of the statisticians concerning the exhaustion of the coal supply, as well as the denuding of our

forests, I say when one reflects on these things and then considers that electric power is not dependent on any one particular material for its production, but that nature by its immutable laws transmits through its operations continuously and systematically the element of water harnessed with electric machinery, this resource is adequate to do the work of the world.

"Our government, therefore, in conserving our waterways and many deep waterway movements, is showing appreciation of the necessity of anticipating the time when water power may be one of our chief sources of power supply.

"In the meantime the electrical industry will keep step with the development and progress in all other industrial lines, and I can see no reason why the year 1910 should not register a higher mark in the electrical business than it has heretofore.

"GEO. A. MCKINLOCK, President."

H. M. BYLLESBY & COMPANY.

"Briefly, I believe the outlook for public service companies, as to their financing, the growth of their business and increasing development and improvement in materials and apparatus which they use, had never a brighter outlook than at the commencement of this Year of Grace, 1910.

"In some sections, owing to what I believe are special causes, there is a great deal of hardship being worked upon public service corporations by the officials of the various states, backed up by irritated public opinion. However, I am constrained to believe that even in these cases, both sides will come to a mutual good understanding and that the outcome of the whole agitation will be the recognition of the toil, industry and ability required to successfully conduct any public service corporation, and that the public at the last will not be so unjust as to deprive this talent and labor of its proper reward. From our observation the ideal situation in these matters is now obtaining in the State of Wisconsin under its admirable public service commission.

"I think one of the most marked features of the business in which we are engaged is the increasing size of the undertakings, the public awakening to the necessity of merging public service corporations into large holding companies amply equipped with capital and talent. Of course, this does not apply to such public service corporations as from the size of their communities are in themselves huge corporations and to the increasing stability in the minds of the public, as well as in that of the stocks and bonds of public service corporations.

"H. M. BYLLESBY, President."

THE ELECTRIC STORAGE BATTERY COMPANY.

"The storage battery business during the past year has been very satisfactory. The prospects are excellent for an increase in the standard applications of batteries, and for extended uses in a number of new fields. We are, therefore, looking forward to 1910 with confidence that we will have a very satisfactory development of our business.

"CHARLES S. BLIZARD,
"Third Vice-President."

ELECTRIC APPLIANCE COMPANY.

"We think the largely increased volume of business during the last ninety days indicates very clearly that the electrical supply business is back on practically a normal basis, and the signs of general prosperity which are seen on all hands seem to promise a very prosperous year in our line of business. THOS. I. STACEY,
"Secretary and Treasurer."

THE VALENTINE-CLARK COMPANY.

"The 'pole-man' for the last two years has had pretty hard sledding, owing to an over-production in the winters of 1906-7, brought about by heavy buying on the part of large telegraph and telephone companies who did not take the stock and use it after it was produced. This past year has been quiet owing to contemplated consolidation of various of our largest electrical companies. These consolidations are still going on and until finally consummated and a plan of policy outlined covering new construction the pole business will remain quiet.

"The general indications are a normal trade will exist in 1910 in electric light, power and traction work, but the telephone end still being so unsettled we believe the trade will be to a great extent spasmodic. We look for a very light production of cedar poles during the present winter.

"E. L. CLARK, President."

THE LINDSLEY BROTHERS COMPANY.

"We are brim full of hope and faith. This is substantiated by frequent letters from numerous representatives of ours in different parts of Canada and the United States which leads us to believe that the year 1910 will be one of the most prosperous years that the electrical and allied industries has experienced since 1906, and we believe that we will have almost as good business in 1910 and 1911 as we experienced during the years 1906 and 1907; at least it looks that way to us. Inquiries of a very substantial nature are being received more regularly than we have experienced for some time. We appreciate that a large portion of these are for estimates, but we look forward to the time when they will materialize, and we think that the early part of 1910 will be a 'record-breaker.'

"E. A. LINDSLEY, Vice-President."

T. M. PARTRIDGE LUMBER COMPANY.

"From the point of view of the producer of poles, I should certainly say that the outlook for business for 1910 was far brighter than at any time since the fall of 1907.

"In technical properties, depreciation works over time, and a temporary suspension of betterments and renewals has caused a condition where the necessities of this nature have doubled and the business derived from this source alone should be great, even though there was no other business in sight. However, there are many new projects being promoted.

"Since the fall of 1907, owing to the financial conditions and light demand, the production of forest products has been brought to a minimum. The stocks of poles are now light, and any activity whatever will result in good business for all, and certainly higher prices.

"Therefore, I say the outlook for 1910, from the point of view of the pole producer, is bright.

"T. M. PARTRIDGE."

C. H. WORCESTER COMPANY.

"We are very glad to be able to state that we believe the prospects for increased business during the coming year is excellent. The inquiries for poles from the larger consumers have been gratifying during the past two, three months, and we believe that increased sales will be a feature of the early spring trade. We see no reason why the demand for stock during the coming year in electrical construction work should not be satisfactory.

"WM. P. BOWRING, Secretary."

Electrical Progress in Great Britain During 1909

BY ALBERT H. BRIDGE.

The most noticeable and at the same time the most hopeful, feature of the year 1909 in the United Kingdom, has been the great progress made in bringing electricity within the compass of the "small man." This movement, which means so much for the future of all electrical industry, has occupied the close attention of a large proportion of the electricity works managers and engineers and of most manufacturing and importing businesses.

Whether we can ascribe it to a fortuitous concourse of circumstances, or to a resultant inventive and commercial activity following on one circumstance and that the availability of the metallic filament lamp, the forward movement is now in full swing. The wire lamp is everywhere working wonders in reducing the cost of electric lighting on existing installations and that fact together with the very strong support that is being given by other influences, is making it easier to get electrical applications adopted in many places where it seemed impossible before. Engineers have not attempted to conceal the adverse effect upon their output of electricity, but this, of course, has been one of the chief causes leading, or even compelling, some of them to adopt a more energetic campaign for securing additional consumers.

A number of new and cheaper wiring systems have come along at an opportune moment and have received a good deal of attention and success. The lamp-makers have been competing against each other in reducing the prices of the metal filament lamps and while the reductions have been considerable, there are some who prophesy that they will go a good deal farther yet. The makers have also brought out new types of lamps for other voltages and candlepowers and so have materially joined in the movement of winning the public. In the latter part of the year a reduction in the prices of flame arcs commenced, with the idea of making it easier for the small shopkeeper to abandon his old illuminant and adopt electricity.

Before leaving this section of the article mention must be made of the greater spirit of enterprise that is apparent among the electric supply companies. It seems that the coming together of these in the London linking-up proposals and the fact that the prospect of a big competitive power company having been removed, have let loose their pent-up energies. They are now jointly using the daily press in an advertising campaign so conducted as to command the attention of all who read, educating them as to the rightful claims of electricity.

One of the companies has opened a model "Electric Home" in its area, fitted throughout with electric lighting, heating and small power. The house is occupied by a tenant who is under special arrangement to admit the public between certain hours every day, to demonstrate to them the manifold domestic applications of electricity and their convenience and cleanliness. Neither coal nor gas is used for any purpose whatsoever in this house. The interest of the public and the press has been well aroused by this event and it is an example which will no doubt be followed in a good many places. This popularizing work is still very necessary indeed, for really the public does not know yet much that it ought to know.

In regard to power supply in the Metropolitan area the clearing of the air by the defeat of the London Power Mills and the granting of powers to certain of the existing companies to link up their stations and enter into agreements for mutual assistance, minimizing the risk of breakdown and economizing future capital expenditure, has led to useful efforts to elaborate schemes for meeting coming demands. Under the new arrangements the less favored stations will be able to derive their future supply from those whose area and location enables them to produce electricity under the most advantageous conditions. Municipal and company representatives have held joint sittings with a view to seeing whether they could devise a co-operative scheme to apply in preparing to meet the future needs of the whole of their areas.

As to the industrial districts of the country, apart from London, now that the trade depression is beginning to lift, it is expected that with a return to former prosperity there will come to the various power companies some of that support for which they have been long waiting from the vast extent of British industries which have not yet changed over to electrical working.

The Newcastle-on-Tyne Company has been erecting its new power station at Dunston, from which it will be possible to meet all reasonably probable demands. The Waste Heat and Gas Electrical Generating Stations, Ltd., which in 1908 started its first two stations with plant of a capacity of about 10,600 horsepower, has started two more stations with 4,600 horsepower. The company has agreements with the coke-oven and blast furnace owners for twenty-one years. At Crook, at the collieries of Pease & Partners, waste heat from ninety coke ovens is being utilized at a power station provided in the immediate vicinity by the Bankfoot Power Company; the station has a plant of 3,300 horsepower, supplying three-phase current at 3,000 volts and forty cycles. At Newmains, in Lanarkshire, the Coltness Iron Company, Ltd., has started a new cement factory for making cement from waste furnace slag.

Among rolling mill installations of the year may be named that at the new mills of Thomas Firth & Sons of Tinsley, Sheffield. Here there is a complete electrical equipment comprising two 1,000-kilowatt, 1,000-volt, three-phase turbo-generators, and the rolling mill plant includes eighteen-inch, twelve-inch, ten-inch and eight-inch rod and bar mills, also twenty-inch, eighteen-inch and sixteen-inch sheet mills. Each mill is motor-driven, two are direct-coupled and the remainder rope-driven.

The most modern example of British practice in direct-current rolling mill electrification is that alluded to in Dr. Kapp's recent addresses to the London and provincial meetings of the institution. It is at the steel-works of Sir Alfred Hickman Limited, at Bilston, and has been completed during the year. There is a flywheel set consisting of a 2,000-horsepower, direct-current motor, two ewenty-eight-ton flywheels, and two generators, to give anything between —1,000 and +1,000 volts. The excitation of the motor is adjusted automatically so as to produce a speed variation of the fly-

wheels between 290 and 350 revolutions per minute. From this set a cogging and a barring mill are supplied with energy. The cogging mill motor works a thirty-inch mill, and when cogging down ingots of three tons weight has to develop 4,800 horsepower and for two-second periods once an hour 9,600 horsepower. The barring mill motor works a twenty-four-inch mill, and has to develop 6,000 horsepower, and for two-second periods once an hour, 12,000 horsepower. The maximum speed is 120 revolutions per minute and the time occupied in reversing from maximum speed in one direction to that in the other direction is six seconds. This plant has been supplied by the Electric Construction Company, Limited.

In Birmingham there is very remarkable progress taking place in the adoption of electric power in place of steam. The Corporation power connections are about 12,000 horsepower and one important feature consists in the taking of high-tension supply by twenty-five firms. Over 7,000 kilowatts are used by large works. There are ten rolling mills on the mains, the majority of them also using electricity for tube drawing. Birmingham is the Midland metropolis and it abounds in industrial work connected with the making of automobiles, cycles, engineers' tools, pens and so on, and in these electricity is finding a quite open door. The Yorkshire Electric Power Company is recording improvement, for which in its wonderful area there is plenty of room. The power companies in Scotland are also forging ahead, while the affairs of the South Wales Power Distribution Company still possess interest for some.

Some of the large municipal electric supply works have had recourse to very large storage batteries to assist them in getting over the peak load on their lighting and tramway systems.

The general postoffice authorities are proceeding with the equipment of their new power station on the south side of the Thames, which is to supersede several of their existing isolated installations. Three 500-kilowatt and two 1,000-kilowatt turbo-alternators will generate at 6,600 volts and distribute to the substations in the postoffice main buildings where transformation down to 440, 220 and 110 volts will take place for lifts, conveyors, lighting, and many other purposes. Stepney Borough Council not being able to wait while others settled the Power Bill question, set to work on a new generating station at Blyth's Wharf, which it recently opened, its plant being mentioned in these pages at the time. The London County Council has now in operation two more of its 5,000-kilowatt turbo-generators at Greenwich tramways power station and other extensions there are in progress. A number of the municipal authorities are moving forward with schemes which will shortly make more work for the plant builders; Edinburgh is going to spend $230,000 on new exhaust steam turbine sets for Dewar Place station, in place of three present generators.

A wider interest altogether has been devoted to the applications of electricity in wiring. Among important plants is the Bargoed installation of the Powell Duffryn where the waste gases of blast furnace and coke ovens are utilized, two double acting, four-cycle gas engines of 1,200 horsepower and 2,400 horsepower respectively, being coupled to 825 and 1,655-kilowatt alternators, for supplying three-phase 3,300-volt, fifty-cycle current for power over all the company's collieries in the Rhymney Valley, including some 170 motors, eleven of which are of fifty to 250 horsepower used for haulage purposes. In some of the pies there are large motor-driven centrifugal pumps, two of them being of 950 horsepower. The Lochgelly installation where a modern plant has been put down to supersede a number of scattered isolated plants for various pits, was described at length in these columns a few months ago. The Harton Coal Company has its Harton Colliery at South Shields worked entirely by electricity (2,445 horsepower, including an 800 horsepower winding engine), and at its other collieries it is gradually replacing its steam driven plant by electrically driven. The Harton colliery takes its power from the celebrated Carville power house of the Newcastle-on-Tyne Electric Supply Company. But apart from the interest taken in these and a number of other such plants, electricity in mining has been and still is, passing through a more or less critical period. One of the earliest occurrences of the year was the disaster at the West Stanley pit. In the course of the investigations experts and others made reports, Dr. Thornton of Newcastle said that it was the first time that a large explosion had been said to have possibly orginated from the flashing over of coal-dust between the electric terminals.

There was an attempt to agitate for the removal of electrical installations from the pits in the interests of the miners, but better counsels prevailed, the men being temporarily satisfied with the appointment of special government commissioners to go further into the Electricity Regulations. An Institute of Colliery and Mining Electrical Engineers has been started during the year. It consists of those who have been in charge of colliery electrical equipments who are joining counsels with the object of maintaining a high standard of workmanship and good quality of materials adopted in mines, thus decreasing the number of electrical fatalities.

In the electric traction province there is little indeed to report. The London County Council uprooted its "G.B" surface-contact system and has been proceeding with the equipment of further lines with conduit. Trackless trolley omnibus schemes have been considered but that is as far as they have gone. Some of the proposals are now in the list again for next year. One of the tramway companies equipped an experimental section at Hendon for demonstration purposes and this was described in these pages at the time. An experimental section of tramway equipped on the "S.P" or "Simplex" surface-contact system has also been demonstrated, but just now the tramway financier and others of responsibility are fighting shy of surface contacts. The lack of orders for tramway and railway rolling stock was seriously felt by the builders of such stock and in their last reports they saw no prospect of immediate improvement. Certainly the schemes on foot do not promise anything great in that connection. The London, Brighton and South Coast single-phase railway service was at last started on December 1, and electrical engineers are devoutly hoping for something more in the way of railway electrification work to turn up before long. The Reid-Ramsey steam turbine electric locomotive, based to some extent on the old Heilmann idea of the early nineties, may be got to work before long showing the extent of its capabilities in practice. Three of the London tube railways have introduced an accelerated service of trains and they are also asking Parliament to grant them powers for financial fusion of interests. The

Central London is going to extend its tube line at the city end to meet the Great Eastern terminus at Liverpool street. The British Electrical Federation has produced a scheme for adjusting fares on a farthing basis—"Fair Fares" they are called—on all its electric tramway systems throughout the kingdom.

The drop in the price of aluminum played havoc with the aluminum companies, and from this cause and others they are now engaged on schemes of financial rehabilitation. The Victoria Falls Power Scheme has been to the fore and to the annoyance of British electrical manufacturers, British investors found the capital for German manufacturers to supply the plant for this great undertaking. An agitation urging British bankers to lend more support to British industry, as German banks do to German electrical industry, was the result, with what measure of benefit we have yet to see.

Important changes have been made in the law relating to electric lighting by the passing of the Electric Lighting Act, 1909. The litigation arising under the New Patent Act has more or less seriously concerned those conected with the arc lamp business. Makers of electro-medical apparatus have formed themselves into an association during the year, their interests not being met by any other organization. The Marconi Company has transferred a number of its coast stations to the government for a consideration; developments in the Poulsen high speed wireless telegraph system have taken place. The National Telephone Company has admitted that its policy is not to spend any money as capital expenditure which will not be reproductive by December 31, 1911, when its license falls due. It aroused discussion because it reduced its constructional staff, owing to failure to agree with the Postmaster General concerning the provision of spare plant for use after that date.

The Year's Electrical Developments on the Continent.

BY C. L. DURAND.

ELECTRIC TRACTION.

Very satisfactory progress is to be noted in the field of electric traction on the Continent during the year, both in the adoption of the electric systems upon the railroads in various countries, and the construction of standard gauge lines, as well as the building of many smaller lines and city and suburban tramways. On most of the state railroads in various countries we find an increase in the number of sections which are now equipped, and there are more extensive plans to be developed before long. The French government recently took over the lines of the Western Railroad Company and now proposes to use electric traction for the suburban part of the lines, which are now carrying a heavy traffic. It is probable that the work will be commenced in 1910 and it will involve an outlay of $15,000,000 for the power stations and the equipment of the lines.

In Germany the first step in the electrical equipment of the Prussian state railroads was the use of electric locomotives on the Dessau-Betterfeld section, and it is expected to follow with the Magdeburg-Leipzig Railroad and other lines of some length. The Austrian government is taking measures to equip about 600 miles of railroad in various places, especially where there are heavy gradients. In the southern part of Austria there is to be carried out an extensive work in the equipment of the Fiume-Moravia section on the state railroads in the Adriatic region. Power will be secured from a 30,000-horsepower hydraulic plant in the region.

In Switzerland the construction of the Lötschberg electric railroad and tunnel has been actively carried on during the year. The company will soon equip the Spiez-Frutigen section on this line in order to obtain data for installing a complete outfit for the railroad. During the year there was published the first detailed description of the new Simplon locomotives, which it will be remembered carry two three-phase 850-horsepower motors together with transformers. Electric traction has been discontinued on the Seebach-Wettingen section, as the Federal railroads did not take over the equipment as was expected. This, however, refers to this particular section, as it is well known that the government has extensive plans for using electric traction in the future.

It is proposed to use electric traction in the Mt. Cenis tunnel, where the roadway is to be double tracked as well as upon some of the sections of the Modane-Turin railroad line. The success of the Vattellina system and the Milan-Porto Cerisio line has led the Italian government to undertake the equipment of 200 miles of the state railroads, and the work is to be completed within three years. Electric trains are now running on the Genoa-Bussala section, using three-phase locomotives of 1,500 horsepower.

Regarding metropolitan lines in various cities, we note the opening up of various sections of the Paris subway, and the work on other parts of the line is being carried forward, especially where the line crosses under the Seine, at one point by caisson and at a second point by a double-tube tunnel. Berlin is to have an extensive subway system which will connect the northern and southern districts and will involve an outlay of $15,000,000 for a length of twelve miles. Steps are being taken to use the electric system on the Vienna metropolitan lines and the work will probably be commenced in 1910. The Franz Josef subway line at Budapest is to be extended at both ends, on one side in subway and at the other part on an overhead structure. This later part will connect with the state railroad line.

HYDROELECTRIC DEVELOPMENTS.

As regards the question of power stations, the interest centers mainly in the construction of hydraulic plants, and we note a number of these enterprises in which the stations are laid out for a much greater power than usual. This is noticeable for instance in the great Rjukan plant in Norway, which is now building and is expected to furnish 250,000 horsepower. It is constructed in two stages, each of which uses a 280-metre head of water. The first part of the plant is to be completed in 1910 and will use ten turbine alternator groups of 14,000 horsepower. The current will be employed for nitrogenous product manufacture. In Norway there are also to be erected stations of large power on the falls of Matre and Tyn in the western region, and they will also furnish upwards of 200,000 horsepower when completed.

In Italy there is also considerable progress to report. The Societa Lombarda is increasing the large Brusio plant and will also use current from a station located at Vizzola, so that in all it will dispose of more than 100,000 horsepower. In the north of Italy the Alta Italia Company controls extensive plants for the supply of Turin, and is now using 40,000 horsepower for this purpose. On the Toce and Devero streams near the Swiss frontier there are building three turbine plants which will have a total capacity of 60,000 horsepower. These rivers flow from Lake Devero which lies at 1,840 metres altitude. Naples is to receive a supply of cement from the sources of the Volturno and the plant will lie at forty-five miles distance from the city. It is expected to secure about 20,000 horsepower in this way. At Callestalle and Papigno there are being erected two hydraulic plants for carbide manufacture which will have a combined capacity of 30,000 horsepower.

In France power plants are being most extensively developed in the Mediterranean region, where there is now a network of power lines covering a large extent of territory and taking in Marseilles, Arles, Toulon, Nice and other large cities. To the system there has been recently added a hydraulic plant located on the Vis River near Montpelier, using a 30,000-volt, three-phase power line. The project for erecting a power plant on the Rhone in order to secure a supply of current for Paris is receiving considerable attention at present, and it is possible that the matter may take a practical turn at a not far distant date. It is desired to erect the plant at a point near the Swiss frontier.

A plant has been lately erected in Austria on the Ill River, and it supplies about thirty different localities on the power lines. Among the new plants in Switzerland we note the one which is being erected at Niederried, upon the Itar stream, besides the series of plants which are to be installed upon the Aar at various places on the river so as to secure in all about 100,000 horsepower. The largest of these plants will be located at Guttanen and Innertkirchen.

For Madrid there is soon to be erected a plant on the Isabella Canal which will give a large supply of current. This city is receiving current at present from a network of power lines which also takes in Valencia and other cities. The hydraulic plant is located on the Jucar stream. At the same time the Tajo River will be called upon for about 15,000 horsepower, and there will be a power line sixty miles long, running to Madrid.

An extensive project for combined steam and hydraulic power is shortly to be carried out for the city of Rome. At the city limits is to be erected a steam plant which will furnish about 50,000 horsepower and in the neighboring region on the Aniene River will be installed a hydraulic plant of 20,000 horsepower to work in connection with the former.

ELECTROCHEMICAL PROGRESS.

Electrochemical processes have been mainly developed during the year in the direction of nitrogenous products, calcium carbide and steel manufacture. The plants which manufacture nitrogen products on the Birkeland and Eyde principle are the largest of the kind, and the extensive works at Nottoden, in Norway, are already using 30,000 horsepower for this purpose. In this process the air is passed by an alternating-current arc of special form, which causes the formation of nitrogen compounds, these being afterwards absorbed by proper means. The company is now manufacturing 25,000 tons of nitrogen products annually, at last accounts, but in 1911 it expects to turn out 125,000 tons.

A newer process is being developed by the Badische Anilin Company, on Dr. Schönherr's system. He is able to form an alternating-current arc of no less than fifteen feet length within a tube, by a special process, and the air which is sent through this arc becomes charged with nitrogenous gases. A great future is expected for the new process, and there has been installed at Kristianssand, Norway, an experimental plant of 1,800 horsepower, using three furnaces. The present company has made a combination with the firm which operates the Birkeland-Eyde process, for using different hydraulic plants in Norway in common, keeping the manufacture quite distinct, however. At Nottoden, Doctor Schönherr's process will be used in a large plant which is now building there, and a part of the great Rjukan plant will also be used for this purpose.

Cyanamide is another nitrogenous product for fertilizer use which is commencing to be manufactured on a large scale. It will be remembered that the compound is formed by treating calcium carbide at a high heat by nitrogen, so that the gas is absorbed. Among the leading factories there is the French plant, located at Notre Dame de Briancon, which now produces 13,000 tons annually, the Martigny plant in Switzerland (4,400 tons), the new factory at Odda, Norway (13,000 tons), as well as the German plant of Trasberg and the Callestalle plant in Italy, which have about the same capacity as the latter. One of the largest factories for cyanamide is located at Sebenico, Dalmatia, and it produces 30,000 tons. There are a number of other plants on the Continent engaged in the same manufacture.

Regarding carbide processes, one of the most recent has been developed at Vienna by Doctor Helfenstein, and his object is to make a furnace which has as large an output as possible. He succeeds in using 3,000 kilowatts per electrode, working at 40,000 amperes and seventy-five volts, on three-phase current. His type of furnace uses 10,000 horsepower and can produce 120 tons of carbide in twenty-four hours.

Steel is produced on the Continent at present by four leading methods, these being the Kjellin process in Norway, the Héroult and the Girod in France and the Stassano process in Italy. The Kjellin type of furnace is the largest of these, as it takes a charge of forty-seven tons and has an output of nine tons. There are now eighteen of these furnaces in operation.

TELEGRAPHY AND TELEPHONY.

In telegraph and telephone work we may mention the recent trials which were made in France with Professor Mercadier's system of multiple telegraphy on the vibratory principle. Each message is sent by vibratory current furnished by a tuning fork, so that a number of messages pass over the wire at different vibration rates, and these are selected out by a set of resonators at the other end. He operated the apparatus between Paris and Marseilles (500 miles) and had very good results, sending from twelve to eighteen messages at a time over the wire.

The Pollak-Virag rapid telegraphy system was recently tested upon a line from Budapest to Pressburg, a distance of 135 miles. On this occasion it worked at the rate of 45,000 words an hour. It was afterwards tried on the Berlin-Königsberg line (430 miles) and showed about the same speed.

The long-distance telephone recently brought out by the Swedish inventors, Egner and Holmstrom, is attracting

considerable attention. After having been tested between Stockholm and Berlin, it was then tried between Stockholm and Paris, a distance of 1,360 miles. The results in this case were quite satisfactory and it is no doubt that even longer distances can be covered. The principle of their transmitter consists in the use of a light steel cylinder mounted on the diaphragm so as to press upon a large surface of granulated carbon.

The question of transmitting photographs over the wire continues to occupy the attention of inventors. We have Doctor Korn's system, which uses the action of light on selenium, passing through a revolving photographic film to reproduce the light and dark parts on a sensitive film at the other end. The Italian inventor, Bernocchi, proposes to use a selenium cell in the same way, but in order to cause fluctuations in an arc lamp. The beam is projected to a distance (which would be a short one, however) and is then made to reproduce an image. Various devices act on the contact principle, using a photograph in the shape of a half-tone wrapped about a cylinder, with make and break at the insulated and copper portions, or else a picture in relief whose surface raises or lowers a light lever so as to vary the current, as in the Senlecq device. As regards the question of tele-vision, or "seeing by electricity," there have been circulated a number of sensational reports on the subject, but seeing that no inventor has yet transmitted an image over the wire, we have still to wait for any definite results in this field.

WIRELESS TELEGRAPHY AND TELEPHONY.

In the field of wireless telegraphy and telephony there is considerable progress to be noted during the year. One of the largest undertakings is the construction of the high power underground station at the Eiffel Tower, and owing to the fact that the apparatus will have a capacity of 100 horsepower, added to the great height of the antenna, or 985 feet, we will no doubt see very long distances covered, seeing that even with the present fifteen-horsepower apparatus messages could be received from the station in Canada. The aerial is formed of six steel cables, which are anchored in stone pillars at the ground, with a cross-bracing of smaller wires. The station is to be used exclusively for military purposes, and is placed underground mainly to prevent the signals from being heard at the outside. The French Government is occupied in establishing a complete system of wireless posts so as to cover the whole country, including the newly-opened station on the Mediterranean at Toulon and a number of plants located in the various ports on the Atlantic and the English Channel.

In Germany there is building a wireless station of some size on the Finow Canal, and it is designed mainly for carrying out experiments of various kinds, especially as to various types of antenna. The mast is about 250 feet high.

A system of wireless posts which will cover a considerable area is now being erected in the region of Gibraltar and the Canary Islands, this work being carried on by the Paris Wireless Telegraph Company in connection with a Spanish company which was formed for the purpose. The object is to connect from the islands with the shore and also with the vessels of the steamship lines for South America which pass here. One station is now building at Santa Cruz in the Teneriffe Island and the second at Las Palmas, both in the Canaries. A third station is to be located on the coast at Cadiz. The vessels can thus make connection with the continent or the islands for a distance of 2,000 or 3,000 miles.

Of great interest are the experiments made by Messrs. Bellini and Tosi for directing wireless messages. Owing to the use of a double antenna consisting of two aerials mounted at right angles, and an instrument known as a "radiogoniometer," placed in the station, the waves can be directed to various points of the horizon and they are cut off from the posts situated at the sides and rear. In the same way they are able to receive messages from posts situated within a certain angle to the exclusion of others. Very conclusive tests were made between Dieppe and other posts in France on the Channel coast.

A new company, the Carpentier-Gaiffe-Rochefort firm, has been lately formed at Paris, and it is already entering the wireless field quite extensively. Among others it is erecting what will be probably the largest station in South America, in Brazil, on the Island of Fernando Noronka. It will have an antenna mounted on four pillars—towers of 230 feet height.

Among the leading work in wireless telephony we may mention the experiments carried out by Lieutenants Colin and Jeance, of the French Navy. They use an apparatus containing a number of arcs mounted in series, with a special form of electrode and burning in an inclosed chamber. On the last tests made on the Mediterranean, between the port of Toulon and the vessel *Conde*, they were able to cover a distance of 104 miles in the presence of various officers of the marine. Professor Majorana, of the telegraphic establishment of Rome, made some interesting experiments, using a new form of transmitter which he calls "hydraulic microphone," and as a receiver a bolometer or the "audion." The Italian government is interested in the matter, and owing to its aid he was able to connect from Rome to various points in Sicily, reaching a distance of 250 miles.

United Service Company of New York.

The United Service Company, of Forty Wall street, New York city, has recently issued a circular letter announcing the incorporation under the laws of the State of New York. The company is capatilized at $100,000 of which $35,000 has been paid in.

This company has been organized for the purpose of dealing in supplies of all kinds, especially equipment and supplies necessary for the operation of railways, both steam and electric; electric light companies; gas companies and water companies; and it will do the purchasing for the subsidiary companies of the Susquehanna Railway, Light and Power Company. This company will take over as of January 1st, 1910, the entire business of the Railways Equipment Company, which is now doing a similar business; and all contracts now existing with the Railways Equipment Company will be assigned to the United Service Company.

The office of the United Service Company is located at No. 40 Wall Street, New York city, and the officers are: S. J. Dill, president; Henry Morgan, vice-president; A. V. Wainright, secretary; W. D. Martin, treasurer; F. G. Robinson, purchasing agent.

Another Isolated Plant Abolished.

Even in far-off Africa the isolated plant is giving way before the central station, the latest instance reported being that of the New Goch Mining Company which has discontinued its own electric plant and is now taking power from the supply mains of the Victoria Falls Power Company.

USES OF ELECTRICITY IN THE NEW WHITE HOUSE OFFICES.

BY WALDON FAWCETT.

The greatest possible utilization of electricity has been made in connection with the equipment of the new office building recently completed for the use of the President of the United States. This business "annex" of the White House constitutes an extension, or rather a reconstruction, of the executive office building which was erected, adjoining the presidential mansion during the Roosevelt administration. The recent enlargement of the structure which involved an outlay of considerably more than $50,000 has doubled the size of the original building. The primary purpose of the enterprise was to provide larger quarters for each existing branch of the executive business establishment rather than to afford facilities for any new departures in this sphere.

Although the wiring of the new office building is a model in its class and the electric lighting fixtures are notable from an artistic as well as an illuminating standpoint, the greatest electrical interest in the new building is focused upon what is known as the Telephone and Telegraph Bureau. This institution is probable the most unique in the country, not even the wealthiest of American business corporations having at their disposal institutions which in comprehensive and economical conduct and scope of operations will compare with this "intelligence office" through which the chief magistrate of the United States keeps closely in touch with the affairs of the world.

Ever since the Spanish-American war the telepgraph and telephone room—or, as it is officially designated, the Telegraph and Cipher Bureau of the Executive Office—has been one of the most important features of the presidential business establishment but the arrangement and equipment of this "nerve center" is indefinitely superior in the new quarters to the status at any previous time. The new telephone and telegraph bureau adjoins, on the one hand, the general staff room—the working headquarters of the President's clerks and stenographers—and, on the other hand, the office of the secretary to the President. Just beyond is the President's private office so that the chief executive or his right-hand man can reach the hub of electrical communication with very little trouble.

The President makes most of his visits to the bureau for the purpose of using the long-distance telephone and a novelty in the newly-furnished communicative headquarters is a specially designed telephone booth, claimed to be the finest booth and the only one of its kind in the world. In general appearance it conforms very closely to the ordinary type of booth to be found in hotels, railway stations and business houses all over the country. The oak wood of which it is constructed has been specially selected for its grain and the plate glass in the doors and windows is unusually heavy but in general arrangement the booth conforms closely to prevailing standards. The distinctive characteristic is the roominess of the interior. Not only will the booth accommodate satisfactorily so big a man as President Taft but there is ample space for a stenographer to stand beside the President's chair inside the booth. There are also facilities whereby, if desired, this booth can in warm weather be connected with the novel air-cooling system which has been installed in the White House offices for the purpose of making it habitable.

Through the medium of his telephonic clearing house, with an operator on duty night and day, the President has the entire official world at his ear. First of all, this bureau constitutes the central of the White House private telephone system. This system has eighteen inside stations covering the living quarters of the presidential family, the business offices, the kitchens, laundry, stable and garage, and finally the headquarters of the police force of thirty-two men that guards the White House and grounds. Through this private exchange connection can, of course, be made with any of the thousands of telephones in the public system of the city of Washington.

In addition to the public system, a special, private telephone wire leads from the White House to each of the nine departments of the government in Washington. The main purpose of this system is to enable the chief magistrate to consult, at any time, with any one of his nine cabinet officers without any danger of eavesdropping, but, of course, should the President desire to communicate confidentially by telephone with any of the subordinates in any of the departmnets it is a simple matter to summon such official to the secret telephone rather than to have him communicate with the White House via the regular telephonic channels.

THE NEW PRESIDENTIAL OFFICE BUILDING, WASHINGTON, D. C.

Equally important as arteries of quick communication are the two special telephone wires leading from the White House to the Uinted States Capitol. One of these lines leads into the great exchange at the legislative headquarters and through this "central" the President can get connection with the private office of any senator or representative, or with the cloakrooms or

other principal apartments of the Capitol proper or the adjacent office buildings of the United States Senate and House of Representatives. The other line from the White House to the Capitol is a strictly secret one. Not only does it not enter the exchange at the Capitol but the terminal is not accessible to any person save with the President's sanction. It is safe to assert that there are men who have been in Congress for years who do not know of the existence of this secret line to the White House, much less know the location of its terminal. However, the line serves an important purpose for it enables the President to confer at any time with the Vice-President or with any senator, representative or other official.

While the telephonic section of the White House bureau exemplifies the latest approved practice through its new switchboard and other adjuncts, it is in no sense more modern or more

PRIVATE TELEPHONE EXCHANGE AT NEW WHITE HOUSE OFFICE.

complete than the presidential telegraph office. The latter, in contrast to the office in use prior to August, 1909, is wired in the most up-to-date manner so that either single or duplex operation is possible. Twenty telegraph wires enter the White House bureau and it is possible to secure a direct line to any point in the country at short notice. The possibilities of the White House facilities in this respect were illustrated on the day the late President McKinley was shot at Buffalo. Within fifteen minutes after the firing of the fatal shot the White House had two special wires, one telegraph and the other long-distance telephone, available to Buffalo, and these were reserved for executive business and more than 5,000 messages were handled during the time the martyr President lay hovering between life and death.

The new equipment of the presidential telegraph office includes disappearing typewriter desks for the operators, each desk being fitted with an Equipose adjustable telegraph arm. There are four operators on the staff of the White House bureau, and under ordinary conditions three of these are on

PRESIDENT'S PRIVATE BOOTH IN NEW WHITE HOUSE OFFICE.

duty during the day and one at night. All the operators are, however, subject to call at any time in the event of a rush of emergency work. Something of the demands made upon these experts may be appreciated from the fact that this little telegraph station has

SWITCHBOARD IN TELEGRAPH AND CIPHER BUREAU.

handled as high as 2,300 individual telegrams in a single day, and this without interference with the function of the bureau as a clearing house for a heavy volume of telephonic business.

The electric current required for lighting and power purposes at the presidential mansion and offices is supplied by a governmental plant (as is customary in the case of all the great public buildings at Washington) rather than by the corporation which furnishes commercial current in the capital city, but the generating plant is not located in either of the structures on the White House grounds. There are various reasons for this, including the considerations of keeping the executive establishment free from the smoke, noise, etc., inevitable in connection with a power plant. The plan that has been followed has been particularly feasible by reason of the fact that the modern electrical power plant of the State, War and Navy Department Building, one of the largest and costliest office buildings in the world, is located directly across the street from the White House offices. From this near-by plant the White House receives 220-volt direct current for power and 110-volt direct current for lighting.

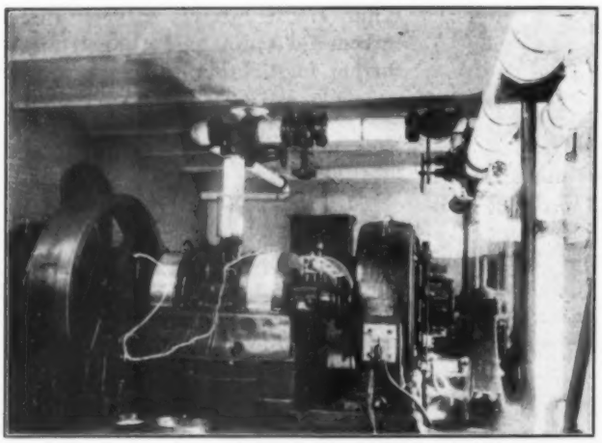
TELEGRAPH OPERATOR RECEIVING DISPATCHES.

Now that the enlarged executive offices are completed there are in the presidential mansion and its business annex nearly 2,000 incandescent lamps, in addition to a large number of arc lights, the latter being employed principally for the illumination of the extensive grounds. A large proportion of the incandescent lamps are of thirty-two candlepower, although many sixteen-candlepower lamps are in use. The total above given is greatly exceeded on the occasion of banquets or other ceremonial social functions and often on such occasions the decorative scheme involves elaborate table designs that require the use of considerable numbers of miniature incandescent lamps. The lighting fixtures both in the mansion and the office building are costly and elaborate. In the famous East Room and the Red, Blue and Green Parlors there are massive chan-

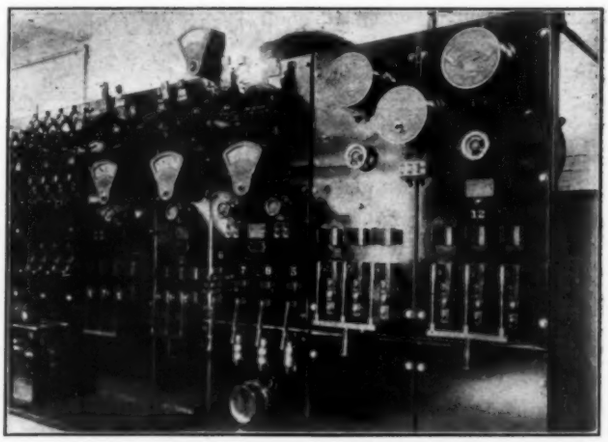
deliers that are notable, and in the vestibule and porte-cochère are huge lanterns of simple but impressive design. In the new office building the dull gold fixtures include chandeliers, wall brackets and desk lamps exemplifying the latest approved designs.

The new presidential office building is a one-story structure and there is, of course, no need for an electric elevator but in the mansion proper there is an electrically operated automatic elevator which runs from the basement to the attic floor, and there are also electrically operated dumb waiters. Electricity also operates more than 200 house and desk fans, as well as a number of exhaust fans in the mansion and office building. In connection with this latter, mention should be made of the unique air-cooling apparatus which has been installed in the new office building. This consists primarily of a huge double-walled cold-storage chamber ten by ten feet in size and fitted with racks of Georgia pine for holding the ice, the foundation and drainage arrangements of the chamber being of concrete construction. A motor-driven fan forces fresh air into the chamber at the rate of 900 cubic feet per minute and maintains a current of air that keeps a constant circulation over the layers of ice. The cooled air passes direct from the cold-storage chamber to the President's office.

Still another electrical adjunct of the new presidential office building is found in a most complete system of bells and buzzers which enable the President or his secretary to summon any member of the White House force without loss of time. Electricity furnishes the motive power for a vacuum cleaning plant which cares for the carpets, hangings, etc., in both the mansion and offices and the current is also utilized for the operation of various appliances in the White House kitchens and for the power machines in the White House laundry. There is one electric automobile in the White House garage at present with the prospect of the addition of other cars of this class.



VIEW OF PLANT WHICH SUPPLIES CURRENT TO THE WHITE HOUSE.



SWITCHBOARD WHICH CONTROLS THE SUPPLY OF ELECTRICITY FOR THE WHITE HOUSE.

Civil Service Engineering Positions Open.

The United States Civil Service Commission announces an examination on January 12, 1910, to secure eligibles from which to make certification to fill vacancies as they may occur in the position of engineer-physicist at $3,000 per annum or associate engineer-physicist at $2,000 to $2,500 per annum, in the Bureau of Standards.

It is desired to secure persons who are fully able to initiate and carry on independent research in the field of engineering physics. They should have training and experience in the inspection and testing of engineering and structural materials, the operation of testing machines, and the interpretation of the results of investigations.

There will be no educational examinations for these positions, but it is essential that applicants should have made and published some contributions of recognized merit in engineering knowledge. Applicants should submit the titles of all papers they may have published and give references to the original source of publication.

Applicants will be rated according to their training, experience, and original investigations, as shown in application Form 1312, procurable from the United States Civil Service Commission, Washington, D. C., or from the secretary of the board of examiners at the post office at Boston, Mass., Philadelphia, Pa., Atlanta, Ga., Cincinnat, Ohio, Chicago, Ill., St. Paul, Minn., Denver, Colo., San Francisco, Cal., the customs-house at New York, N. Y., New Orleans, La., or the old custom-house, St. Louis, Mo. Applicants must furnish on the application form the vouchers of two persons who are able to testify from their personal acquaintance in reference to the fitness of the applicant for the position sought. It is desirable that the vouchers should be persons belonging to the same profession, or pursuing the same line of work as the applicant. Applicants must have been domiciled in the state in which they reside for at least one year previous to their taking the examination.

Age limit, twenty-five years or over on the date of the examination.

The United States Civil Service Commission also announces an examination on January 19, 1910, to secure eligibles from which to make certification to fill two vacancies in the position of engineer in wood preservation, one at $1,000 and the other at $1,300 per annum, Forest Service, for duty in District No. 2, with headquarters at Denver, Colo., and vacancies requiring similar qualifications as they may occur, unless it shall be decided in the interests of the service to fill either or both of the vacancies by reinstatements, transfer, or promotion. Form No. 1312 is required for application.

CENTRAL-STATION PRACTICE

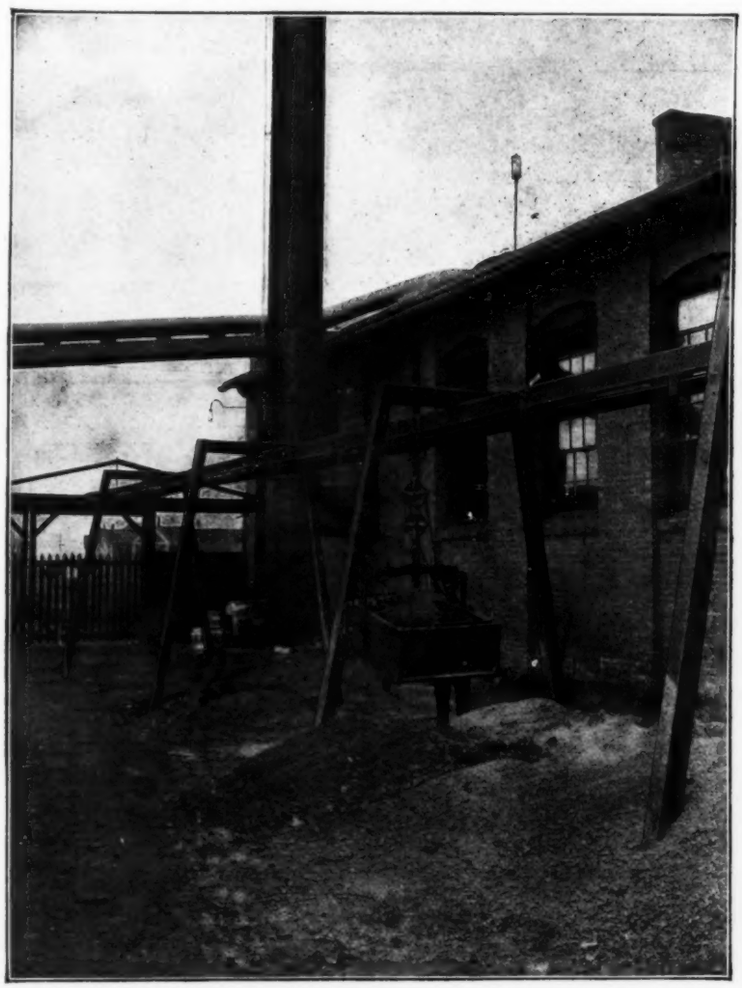
Transmission—Interior Wiring

SOME NOTES ON COAL AND ASHES HANDLING EQUIPMENT.[1]

BY DAVID GAEHR.[2]

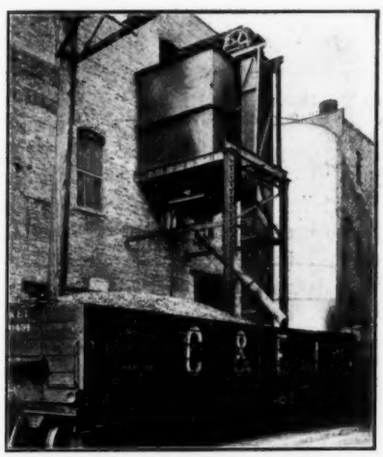
The cost of handling coal and ashes by means of machinery varies between nearly as wide limits as the cost of manual labor to do the same work, and depends largely on local conditions and on the personal equation, which in one case involves the physical capacity of man, and in the other case his ability as a competent designer and constructor.

In a certain foundry a man thinks he is greatly underpaid at $60.00 per month when required to take coal from a pile in the boiler house to which it has been delivered by wagons, or otherwise, and fire it at the rate of about two tons in ten hours, removing the ashes resulting therefrom in a wheelbarrow to a dumping place 100 to 200 feet distant, besides attending to the other duties of the engineer, in the boiler and engine rooms only, of a sixty horsepower plant. Charging one-half of the engineer's time to the boiler room, and allowing the fact that he attends to some repairs to offset the fact that he does not have to unload the coal from the wagons or cars, it costs about fifty-five cents per ton for the handling of coal and ashes from the car or wagon to the ash pile.



PLAIN TROLLEY AND DUMP BUCKET— THE SIMPLEST RIG IN COAL AND ASHES HANDLING.

In a paper mill of 1,500 horsepower (five 125-horsepower horizontal tubular boilers, two 310-horsepower Wickes boilers, and one 250-horsepower Wickes boiler), where coal is delivered in cars on a covered trestle adjoining the boiler house (sometimes in hopper bottom cars, more frequently in gondolas), the coal being wheeled from a pile under the trestle to piles in front of the boilers, from which it is hand-fired, there are employed three firemen at $2.25 per day, three coal passers at $1.80 per day on each of two twelve-hour shifts, besides four shovelers at $1.60 per day of ten hours, who unload two forty-ton cars of coal in each day shift, so that the cost of handling coal and ashes from car to ash dump (just outside the boiler house) is about thirty-eight



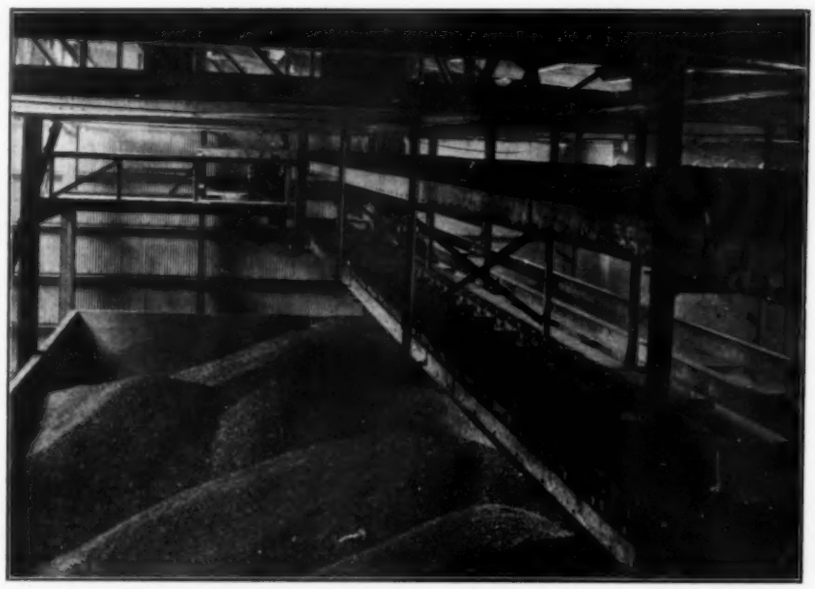
COAL AND ASHES HANDLING SYSTEM, PLANT OF DARLING AND COMPANY, UNION STOCK YARDS, CHICAGO, ILL.

1 Abstract of a paper presented at the twentieth meeting of the Ohio Society of Mechanical, Electrical and Steam Engineers, at Lima, Ohio, November 20, 1909.

2 Contracting Engineer, Cleveland, Ohio.

cents per ton net. If half of the salary ($3.00 per day) of the head fireman, who merely supervises the fireroom, and one third of the salary of the chief engineer ($4.50 per day) are also charged to this item, as it rightly should be, this figure is changed to forty-two cents per ton. In addition to this unwarranted expense, the ashes are shoveled into a wagon and hauled to a more remote place on the premises. The firemen and coal passers are worked so hard, as to force them to improve every opportunity to exchange their jobs for better ones, this making a permanent organization in this power plant almost an impossibility.

Another paper mill has ten 250-horsepower Wickes boilers, with Dutch ovens, supplied with Detroit stokers, and with provision for piling from three to four tons of coal in storage above each oven. The coal is delivered in cars on an elevated trestle located in a building forming a lean-to with the boiler house, the partition wall containing large arches through which the coal flows or is shoveled into a pit within eight feet in front of the stokers (about seven feet deep by twelve feet wide), and extending along the entire length of the boiler house. Whenever a sufficient storage pile can be maintained under the trestle, enough coal flows through the arches into the pit to supply the ordinary demand. When coal is not received fast enough, the storage pile is transferred to the pit by hand shoveling or with the aid of a power shovel. This pit is served by a traveling crane, handling a one-yard dump bucket, and running the entire length of the boiler house. The bucket, when lowered into the pit, is filled by hand shoveling, raised to a point above the ovens and dumped by the operation of a latch from below. Underneath the furnaces there is a track on which runs a combination car and dump bucket, which, when outside of the tunnel, can be reached by the traveler, transferring the ashes dumped into it, twice per shift, to an elevated ash hopper at the end of the building, this hopper having an outside discharge spout, controlled by a gate, from which the contents are drawn into wagons at convenient intervals. This plant employs on the day shift (eleven hours) one head fireman at $2.25, one assistant fireman at $2.00, three coal passers at $1.75, and on shoveler at $2.00, who unloads two fifty-ton cars per day, whether received in gondola or hopper bottom cars (though probably the majority are of the latter kind and so stipulated in the contract for coal), and this rate of pay is fixed whether the cars come in uniformly or spasmodically. This day gang stores up a good deal of coal over the ovens and handles more ashes than the night gang, which consists of one fireman at $2.25, one assistant at $2.00 and two coal passers at $1.75, all working thirteen hours, the two gangs alternating at regular intervals. Charging one-third of the chief engineer's time (at $6.00 per day) to the cost of handling and firing the coal and removing the ashes, we obtain a rate of twenty-one and one-third cents per ton, and in severely cold weather, when the coal consumption is increased about one-fifth, without addition to the crew, this figure is reduced to about eighteen cents per ton.



SUSPENDED FLIGHT CONVEYOR DISCHARGING COAL INTO BUNKERS, DELAWARE AVENUE POWER STATION, PHILADELPHIA RAPID TRANSIT COMPANY, PHILADELPHIA, PA.

COAL AND ASH HANDLING SYSTEM, POWER PLANT, GRAND TRUNK RAILWAY COMPANY, STRATFORD, ONT.—CAPACITY, TWENTY TONS AN HOUR.

These are three representative cases, well known to the writer, and chosen at random for sake of illustration, though offering many points for interesting comparison.

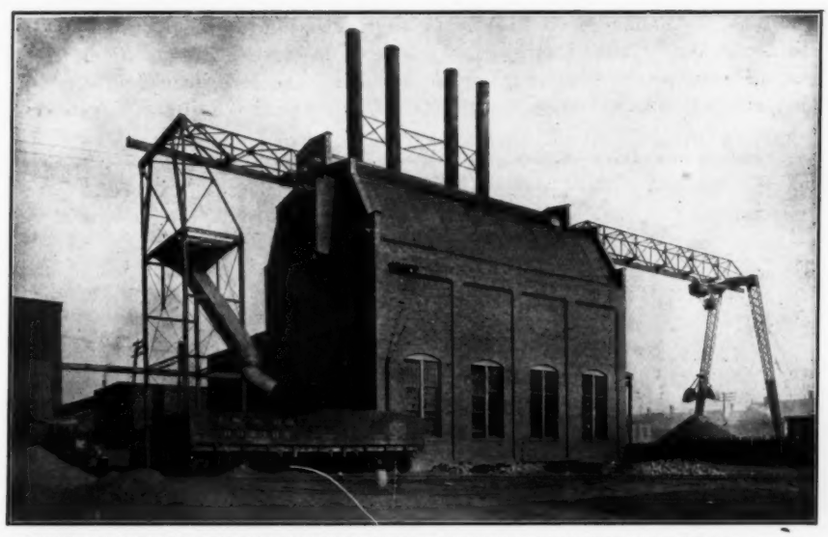
In the first case no thought whatever

was given to the matter of storage, nor even to the convenience of handling the fuel and ashes, though, with a suitable system such as explained subsequently, the cost of coal and ash handling might have been cut at least in two.

In the second case some thought was given to the problem as shown by the fact that a trestle was provided. This, however, had but seven feet of space below, giving an entirely inadequate storage capacity, though this was supplemented by space allowed on the side of the tracks away from the boiler house, all under cover, from which it was wheeled under the trestle to the boilers. The expensive item here, as in every case, is the shoveling and transferring. Had the trestle been of sufficient elevation, even though it may have required a car puller, hoppers with gates might have been constructed under the trestle from which the coal could have been drawn into the cars, operating on an industrial railway track, being shoveled directly from the car (which can be provided with a drop side) into the furnaces, relieving the action, thereby enabling them to attend firemen of the back-bending and lifting to more furnaces, and at the same time keeping the boiler room in much neater condition. The coal might also have been taken from the bin gates into a dump bucket, carried on an electric hoist, operated on an overhead trolley system. This would not alleviate the work of the firemen perceptibly in regard to handling coal, but the transfer from bin to boiler would be facilitated, since motor-driven trolleys might be used and several coal passers easily eliminated.

REAR VIEW OF POWER PLANT OF LAKE ERIE IRON COMPANY.

Similarly pits might be built in front of the ash doors, into which the bucket could be lowered, so as to have the brim flush with the floor, enabling the ashes to be raked into it, instead of drawing them out on the floor and then shoveling them into a wheelbarrow, merely to transfer them to another place from which they must again be removed with due amount of labor. It is to be noticed also that in this case it takes four men to unload eighty tons daily, whereas in the third case, one man unloads 100 tons daily, though he probably receives more hopper-bottom cars than the others. Inasmuch as he obtains the same wages whether putting in long or short hours, he has established for himself an entirely different standard from that actuating the other men.



POWER PLANT OF THE LAKE ERIE IRON COMPANY, SHOWING MONORAIL GRAB-BUCKET INSTALLATION.

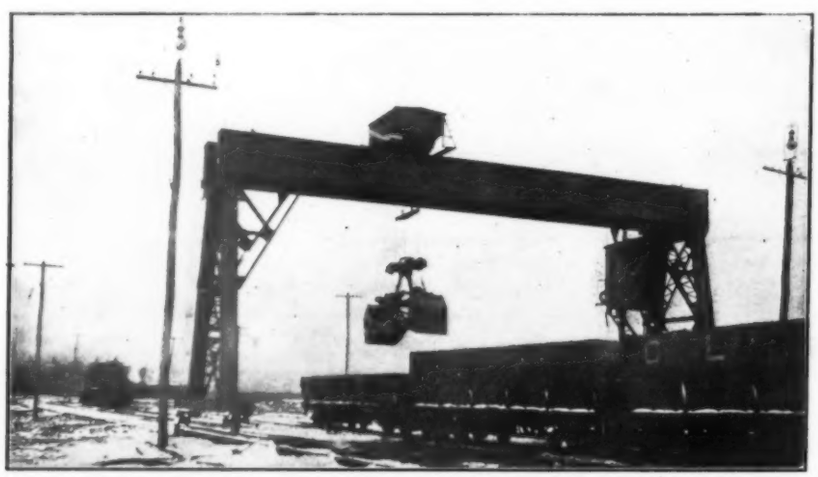
An installation of this kind, at an expense of about $700 for the bucket, electric hoist, trolley and overhead track, and an expense of about $3,000 for elevating the tracks, installing hopper-bottom bins with gates underneath, would eliminate at least two coal passers on every shift, and, if a better provision were made at the same time for unloading, and hopper-bottom cars insisted on, at least two shovelers could be eliminated. This small installation would not cut down the number of firemen, but would ease their work materially, and make for a more permanent organization. Thus, at an expense of from about $3,700 to $4,000, a minimum saving of $10.40 per day could be effected, amounting to $3,796 per year, say $3,800 (the plant running continually for the entire year), which represents a justifiable investment of $25,306, allowing five per cent for interest on capital involved, and ten per cent for depreciation. In other words, they would save annually nearly 100 per cent on the investment. It is doubtful if any other part of the plant could be made to bring such returns.

If stokers were installed, a further saving in coal and cost of firing could be effected, and if adequate coal storage were provided, expensive delays and much anxiety could be prevented. This merely illustrates how by a simple improvement the cost of handling coal could be reduced from forty-two cents per ton to twenty-eight and three-fourths cents per ton, which is still a very high rate compared with plants in which all the refinements and latest developments in this line of machinery have been given due consideration at the time the plant was designed and installed

In the last case cited the traveler was a very flimsy and poorly designed piece of machinery, and illustrated fully through the trouble it caused and through its slow operation, that the saving in the first cost of an installation, if made at the expense of quality, is usually found to be false economy, and in contracting for such work, competent engineers should be allowed to make the choice. Had the traveler been equipped with a grab bucket, and provision made to have it serve a storage pile outside, and had a hopper bottom been placed under the trestle, so as to allow all coal to flow into the pit, a saving of at least $5.25 per day could have been effected (by eliminating three coal passers) at an expense of

about $2,000 for the bottom under the trestle, and $4,000 for a new traveler with a grab bucket. So an investment of $6,000 would produce a saving of $1,916 per year, which would really justify an expense of $12,733, allowing five per cent interest on the investment, and ten per cent for depreciation. To build the proper kind of a storage yard, and to serve this with the same crane on a runway extended out through the building, would be possible, but not advisable. A conveyor could be installed to advantage and an installation of this kind might amount to from $5,000 to $10,000, depending on the quality of the work. The design of a large plant will bring out even more conspicuous figures.

Prof. G. F. Gebhardt in his book "Steam Power Plant Engineering" gives a description of various types of plants and cost data. Amongst these he



A GANTRY-CRANE GRAB-BUCKET INSTALLATION HANDLING CINDERS FROM PIT TO CARS.

gives the cost of handling coal from coal car to ash car as from ten cents to eighteen cents per ton in large plants consuming 200 tons daily and equipped with stokers and conveyors, this including the wages of firemen and water tenders. In some plants the cost is divided into: (1) Cost of unloading from cars or barges; (2) cost of conveying coal into bunkers; (3) cost of feeding coal to furnace; (4) cost of removing ashes—but ordinarily the cost from coal car to ash car gives all necessary information for a basis of comparison. Professor Gebhardt gives as an average figure for handling coal by barrow and shovel as about 1.6 cents per ton per yard distance wheeled, up to distances of five yards, and then about one cent per yard additional for longer distances.

"With automatic conveyors the operating cost, including wages of firemen and water tenders, varies with the size of the plant and the type of conveyor, and ranges anywhere from a fraction of one cent to four or five cents per ton. The larger the plant and the greater the amount of coal handled, the lower will be the cost per ton."

A number of specific instances are cited describing the equipment, giving cost of installation and cost of operation, which in one case is as low as 1.5 cents per ton in a plant consuming 1,600 tons daily.

Walter G. Hudson in two articles on this subject, appearing in the July and August '09 issues of the *Engineering Magazine* gives figures practically substantiating those given above and offers interesting descriptions of a number of modern installations.

The American Railway Engineering and Maintenance of Way Association has given this subject serious thought, and the report of a committee appointed to investigate the various types of railway coaling stations presents some very interesting reading matter. It describes: (1) post or pillar cranes, on loading platforms, operating buckets; (2) trestles over bins, from which coal is spouted into locomotives; (3) locomotive cranes with grab buckets; (4) two buckets alternately raised and lowered, taking coal from a track hopper to an overhead bunker; (5) bucket elevators and conveyors, serving overhead bunkers; (6) belt conveyors; with a brief reference to (7) monorail grab-bucket cranes.

Thanks are due to the Webster Manufacturing Company, 2410 West Fifteenth Street, Chicago, Ill., for the loan of the photographs from which the second, third and fourth of the above illustrations were made. The Webster Company was responsible for these typical installations. For the other illustrations we are indebted to the kindly co-operation of Mr. Gaehr, the author of the paper.

Electrical Industry in Siam.

Vice-Consul-General Carl C. Hansen, of Bangkok, gives the following interesting particulars of electrical industry in Siam:

The light and power plant for Bangkok is furnished by the Siam Electricity Company (Limited), a Danish company. Its equipment consists of Babcock & Wilcox boilers, triple-expansion engines, Curtis turbine, and others; Morley, General Electric, Short, and other dynamos; Terrarie, Thompson, General Electric, and other motors. The electric power at the consumers' terminals is 100 volts, 100 cycle, single-phase. The company began operations in September, 1890, and is the only electric-supply company in Siam. It furnishes the electric power and light for the city of Bangkok, both public and private, and also supplies the electric power for the twenty-five-mile single-track overhead-trolley system of tramways. This company represents an investment of $1,500,000, and paid a dividend last year of twelve per cent and a bonus of $1.50. The original shares were issued at about $50 each, and at last quotation were valued at about $180.

The telegraphs are owned and operated by the Government. The telegraphs and posts are under one directorship, and the income from these two departments for the year 1906-7 was $352,381, and the expenditures $427,275, leaving a deficit of $74,894. Siam has, up to the present, no wireless telegraphy in operation.

The Government also owns and operates the telephones. A new installation was finished this year. It is of the central-battery system, arranged on the common-battery principle, for 1,500 subscribers. The electric power, obtained from the Siam Electricity Company, is 110 volts, 100 cycle, single-phase, and two sets of motor-generators. The rate is $5.50 monthly.

Bangkok affords a good market for electrical toys of every description.

ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

STREET LIGHTING IN THE CITY OF NEW YORK.

BY H. THURSTON OWENS.

Much has been written regarding the campaign for better lighting in the cities of the country and but little concerning the largest and in many respects the most progressive of them all. The city of New York not only leads in size, population and the number of its public lamps, but also in the time and money spent in improvements along both engineering and artistic lines.

New York has the largest installation of electric lamps for public lighting in the world and is second only to London in the number of gas lamps.

The statistics in round numbers showing the lighting conditions in New York are given in Table I.

TABLE I.
SHOWING LIGHTING CONDITIONS IN NEW YORK.

Population	4,500,000
Square miles	307
Miles of highways	4,000
Gas lamps	45,000
Naphtha lamps	2,000
Arc lamps	16,000
Incandescent lamps	10,000
Total street lamps	73,000
Annual cost	$3,000,000

The public lighting is under the supervision of John H. O'Brien, commissioner of water supply, gas and electricity, and under the direct charge of Chas. F. Lacombe, chief engineer of light and power. The gas and naphtha lamps are maintained by a contracting company and the electric lamps by the companies supplying the current, all under yearly contracts beginning January 1 of each year.

The city is divided into five boroughs and the contractors, lamps and prices for the year 1909 are given in Table II.

TABLE II.
SHOWING THE NUMBER, TYPE AND PRICE (1909) PER ANNUM OF THE LAMPS SUPPLIED BY EACH CONTRACTOR.

BOROUGH OF MANHATTAN.

Contractor and Type of Lamp.	Number.	Size.	Price.
New York Edison Co.—			
Flame lamps	20	10-12 Amp.	....*
Twin inclosed arcs	176	900 W.	$164.25
Single inclosed arcs	2,272	450 W.	100.00
Single inclosed arcs	2,034	450 W.	95.00
Single inclosed arcs	24	325 W.	90.00
Tungsten incandescent.	2,138	75- 85 W.	28.00
Tungsten incandescent.	30	50- 55 W.	22.50
Carbon incandescent	16	90-100 W.	22.50
United Electric Light and Power Co.—			
Single inclosed arcs	434	450 W.	100.00
Single inclosed arcs (city equipment)	26	450 W.	90.00
Tungsten incandescent.	21	75- 85 W.	28.00
Tungsten (city equipment	11	75- 85 W.	25.20
Tungsten (city equipment	34	50- 55 W.	20.25
Carbon incandescent	5	90-100 W.	22.50
Welsbach Street Lighting Co.—			
Mantle gas lamps	14,200	3½ cu. ft.	12.00†
Open flame gas	38	3 cu. ft.	6.00‡
Mantle naphtha	137	.....	28.00
Total	21,616		

BOROUGH OF THE BRONX.

New York Edison Co.—			
Single inclosed arcs	1,498	450 W.	100.00
Tungsten incandescent.	609	75- 85 W.	30.00
Carbon incandescent	4	90-100 W.	25.00
Westchester Lighting Co.—			
Single inclosed arcs	284	450 W.	100.00
Tungsten incandescent.	487	75- 85 W.	30.00
Carbon incandescent	4	90-100 W.	25.00
Bronx Gas & Electric Co.—			
Single inclosed arcs	756	400 W.	102.56
Tungsten incandescent.	323	75- 85 W.	28.10
Welsbach Street Lighting Co.—			
Mantle gas lamps	6,495	3½ cu. ft.	12.00†
Open flame	59	3 cu. ft.	6.00‡
Mantle naphtha	1,325	.....	28.00
Total	11,844		

BOROUGH OF BROOKLYN.

Edison Electric Illuminating Co.—			
Single inclosed arcs	4,364	450 W.	100.00
Single inclosed arcs	192	325 W.	90.00
Tungsten (company posts)	23	75- 85 W.	30.00
Tungsten (city posts)	130	75- 85 W.	28.00
Flatbush Gas Co.—			
Single inclosed arcs	820	450 W.	100.00
N. Y. & N. J. Globe Gas Light Co.—			
Mantle gas lamps	14,245	3½ cu. ft.	13.32†
Kings County Lighting Co.—			
Mantle gas lamps	4,558	3½ cu. ft.	28.00
Welsbach Street Lighting Co.—			
Mantle naphtha	604	.....	28.00
Open flame naphtha	12	.....	22.50
Total	24,950		

BOROUGH OF QUEENS.

N. Y. & Queens Electric Light & Power Co.—			
Single inclosed arcs	2,016	450 W.	100.00
Single inclosed arcs (city equipment)	27	450 W.	90.00
Tungsten incandescent.	2,289	75- 85 W.	31.02
Queens Borough Gas & Electric Co.—			
Single inclosed arcs	239	325 W.	90.00
Tungsten incandescent.	280	75- 85 W.	31.25
N. Y. & N. J. Globe Gas Light Co.—			
Mantle gas lamps	4,905	3½ cu. ft.	13.98†
Total	9,756		

BOROUGH OF RICHMOND.

Richmond Light & R. R. Co.—			
Single inclosed arcs	730	450 W.	100.00
Tungsten incandescent.	3,839	75- 85 W.	29.00
Welsbach Street Lighting Co.—			
Mantle gas lamps	240	3½ cu. ft.	13.98†
Total	4,809		

* Not settled.
† Add $10.37 for gas.
‡ Add $8.89 for gas.
There are additional expenses for repairs to gas and tungsten lamp-posts which are the property of the city.

Comparing the conditions existing at the present time with those six years ago the changes have been nothing less than revolutionary, as will be seen by the types of lamps in use at the end of 1903 and 1909 as given in Table III. During this period the population increased from 3,840,000 to 4,500,000.

TABLE III.
SHOWING TYPES OF LAMPS IN USE AT THE END OF 1903 AND THE END OF 1909.

Lamps.	1903	1909
Electric Arcs—		
Flame	....	20
Twin 500 Watt D. C.	206	....
Twin 500 Watt D. C.	....	176
Single 450 Watt D. C.	2,677	5,760
Single 450 Watt A. C.	1,362	8,745
Single 400 Watt A. C.	1,204	756
Single 325 Watt A. C. and D. C.	6,788	455
Single 250 Watt D. C	210	....
Electric Incandescent—		
Tungsten 75 Watt	....	10,150
Tungsten 50 Watt	....	64
Carbon 90 Watt	4,168	29
Gas—		
Double mantle	16	....
Single mantle	9,711	44,643
Open flame	31,967	99
Naphtha—		
Mantle	1,702	2,066
Open flame	2,356	12
Oil—		
Open flame	100	....
Total	62,467	72,975

Although the increase of over 10,000 lamps in six years is a notable one, the change in the type of lamp is of far greater importance. Over 7,000 arc lamps have been raised to the standard 450-watt size, 4,000 carbon and nearly 2,000 fifty-watt tungsten incandescent lamps have been changed to seventy-five to eighty-five-watt tungsten lamps, and 4,000 additional have been erected.

One-half of the fifty-watt tungsten lamps changed were in the Borough of Queens, supplied by the Queens Borough Gas and Electric Company, the work being done during the past year. In the same period this company changed over 2,000 325-watt arc lamps to the 450-watt size.

During 1909 the Richmond Light and Railroad Company changed nearly 4,000 ninety to one hundred-watt carbon lamps to seventy-five to eighty-five-watt tungsten lamps in the Borough of Richmond, Staten Island.

In the Borough of The Bronx some 800 tungsten fifty to fifty-five-watt lamps were changed to the seventy-five to eighty-five watt size also during the past year.

Over seventy-five per cent of the gas

lamps were of the obsolete open-flame type, and these have practically all been changed to mantle burners. The naphtha lamps were changed to the mantle type also, but have since been replaced by either tungsten or gas, and the oil lamps permanently removed.

This only tells part of the story, however, for thousands of lamps of all types have been relocated, partly on account of public improvements, but mainly to provide more adequate light upon each type of thoroughfare according to the conditions prevailing.

Business streets and all main avenues are lighted by arc lamps, residence streets by gas, parks by tungsten, and outlying roads by gas or tungsten lamps. Nearly all of the electric lamps in Manhattan and about one-third of those in Brooklyn are on multiple circuits and the balance are series lamps.

FIXTURES.

The question of the appearance of street-lighting fixtures is one which has been sadly neglected in the majority of instances in this country, but New York has much to be proud of in this regard.

FIG. 1.—FIFTH AVENUE IN 1892.

FIG. 2.—FIFTH AVENUE, NEW YORK CITY, IN 1902.

The first electric light poles erected in New York, on Broadway in 1879, were of cast iron, twenty feet in height, the lamp being placed above the pole, twenty-one feet above the ground.

Fifth Avenue was lighted by means of arc lamps the next year, one being placed at each street intersection, or 260 feet apart, but wodoen poles were used. Twelve years later New York decided to spruce up for the Columbian celebration in 1892, and twin open-arc lamps were installed, on ornamental poles, two pairs to the block, or four times as many lamps. These were connected two in series on the 120-volt lines and are shown in Fig. 1. Ten years later, 1902, the lamps were changed to the inclosed type shown in Fig. 2. These consumed 500 watts per pair and were hung seventeen feet above the ground.

During the past year and just prior to the Hudson-Fulton celebration the installation was nearly trebled, as one more pair of lamps was placed upon each block, and the wattage of each

FIG. 3.—FIFTH AVENUE POST IN 1909.

pair raised from 500 to 900, or from twenty to fifty-four kilowatts to the mile for a distance of five miles.

The equipment shown in Fig. 3 was also changed, as the lamps were raised three feet, or to twenty feet above the ground.

FIG. 4.—TUNGSTEN BRACKET USED IN THE BRONX.

When tungsten lamps were first installed on Riverside Drive, in 1908, boulevard lamp-posts which had formerly been used for gas were erected. When it was decided to light Central and Prospect parks with this same lamp it was necessary to obtain more posts. The post was designed by the Municipal Art Commission and plans and specifiations were prepared which were much more exacting both as to requirements and time of delivery than is usual in such work. The post is shown in Fig. 5. This lantern is fitted with an opal reflector and the lamp is ten feet, six inches above the ground, over a foot higher than the boulevard post referred to above.

For special ornamental lighting a smaller post with a fifteen-inch opal ball, as shown in Fig. 6, is to be used. These are to be installed upon the Mall and in front of entrances to buildings, etc.

When completed the installation will consist as follows:

	Type.	No. Lamps.
Central Park	Fig. 5	1,290
Central Park	Fig. 6	54
Central Park	Brackets	17
Central Park West	Fig. 5	92
Prospect Park, Brooklyn	Fig. 5	750

FIG. 5.—TUNGSTEN POST FOR CENTRAL AND PROSPECT PARKS.

FIG. 6.—SPECIAL ORNAMENTAL POST FOR CENTRAL PARK.

There are comparatively few large squares in the city and they have been lighted by inclosed arc lamps up to the present time. This lighting will be superseded by vertical-carbon flame arc lamps taking twelve amperes. They will be hung about fifty feet high, so that, in one sense, history repeats itself, as among the earliest installations of arc lamps in New York city were those installed in Union Square and Madison Square parks. Six lamps in each park were suspended from poles 140 feet above the ground. These poles did not remain very long and ordinary arc lamps connected by means of overhead circuits have remained in use until the present year, when the wires were placed underground and the lamps were changed from clear to opal globes.

Twin 500-watt lamps similar to those in use on Fifth Avenue were also used upon Madison Avenue until the present year, when they were removed and two lamps of the Bishop's crook type were placed at each intersection, a notable feature of the installation being that opal globes were used throughout. This makes a total of fifteen miles of streets lighted by arc lamps with opal globes.

Practically all of the lamps in the Borough of Manhattan and one-third of those in Brooklyn are supplied by means of underground circuits. One of the efforts to make the overhead lines less objectionable is illustrated in Fig. 4, being the bracket used for tungsten lamps in the Westchester district of the New York Edison Company. The standard height for these lamps is fifteen feet above the ground and the standard size seventy-five to eighty-five watts.

In addition to the regular public lighting on street service, there are two bridges with seventy arc lamps supplied from isolated plants, and the three great bridges, Brooklyn, Williamsburgh and Queensboro, are supplied with central-station service on a meter basis at a low rate.

Meetings of the Illuminating Engineering Society.

The New York Section of the Illuminating Engineering Society announces the following papers to be presented at the next four successive meetings: January, "The Lighting of a Bowling Alley"; February, "School Lighting"; March, "Fixture Design"; April, "Decorating."

THE LATEST METHODS OF MANUFACTURING METALLIC LAMP FILAMENTS[1]—I.

BY B. DUSCHNITZ.

In a series of articles on this subject published last year the author had divided the methods of manufacturing metallic lamp filaments into four groups. This arrangement has proved itself suitable for the purpose of reviewing the labors and successes in this field and is therefore retained here in a general way. It is worthy of note that since their appearance no further proposal has been made for the production of filaments directly from oxide-containing rare earths, which seems to prove how difficult and unreliable the manufacture of filaments from such metal oxides and their reduction into pure metal is. On the other hand, there have been several proposals to produce filaments with the aid of organic substances and binding materials. Their manufacture from metals in a colloidal state or from pastes, that is, from solutions and compounds free of carbon, has also been further developed.

The method mostly followed in recent times is to add easily fusible metals to those that fuse with difficulty, in order to attain easy sintering of the latter, and the general aim is to obtain the filament by drawing, pressing or rolling directly from the powdered metal, as these processes offer the best prospects for manufacture on a large scale as well as for high quality of the product. Corresponding to these efforts the methods of manufacturing filaments from pure metal are here divided into two groups, namely those in which fluids are employed, or "wet" processes, and those carried out without fluids, or "dry" processes.

MANUFACTURE WITH THE AID OF ORGANIC SUBSTANCES.

The Wolfram Lamp Company, of Augsburg, Germany, has recently patented a metallic filament consisting of a mixture of metallic tungsten and small quantities of more easily fusible metals for sintering it, as chromium, vanadium, niobium, tantalum, osmium, ruthenium, zirconium or thorium. Greater strength and elasticity of the filament is said to be attained thereby. In order to produce such filaments an organic binding medium, as chloride of zinc cellulose or acetic acid collodion is mixed with the finely subdivided tungsten metal, to which up to fifteen per cent of one or more of the above mentioned metals has been added. The mixture is then formed into filaments in the ordinary way, and the filaments are carbonized after denitration. In this way filaments are obtained that consist of tungsten with a proportion of easily fusible metal and carbon. The carbon is removed by one of the well-known processes.

This method can evidently be effective only when tungsten of high purity is employed, for tungsten containing carbon has a low melting point. The foreign metals added to it are intended to hold the tungsten particles better together, and therefore they must be more easily fusible than the tungsten itself.

The manufacture of raw filaments from carbon-containing paste offers no difficulties in itself, but the removal of the carbon is difficult, if filaments of good resistance are to be obtained. The Siemens & Halske Company discloses a method in German Patent No. 200,886 by means of which the decarbonization of the filaments is said to be effected simply and in a short time, namely by glowing them in acetic acid vapors. For this purpose the filaments are connected to the electrodes and enclosed in a receptacle capable of being exhausted and containing a vessel with acetic acid, which evaporates upon exhausting. The filaments are brought to incandesence by an electric current, the acetic acid vapors in their vicinity are decomposed and effect their decarbonization, which is said to take place with particular rapidity.

Another method of obtaining filaments from carbon-containing substances is described by E. Goosens Pope & Company, Venloo, Holland. Filaments containing at most 0.06 per cent of carbon are said to be produced by its means. A sodium-tungsten solution is mixed with no more than eight per cent of gallic acid and precipitated with acid. The precipitate, which consists of a mixture of low tungsten oxides and small quantities of pyrogallol, is washed first with distilled water and then with equal parts of water and ninety-six per cent alcohol, until all traces of sodium salts have been removed. The black shiny paste thus obtained is pressed into filaments, which must be dried slowly in order

[1] Translated and abstracted *Elektrotechnischer Anzeiger*, Berlin, October 17, October 28, and November 4, 1909.

to give them sufficient solidity for the succeeding processes. The dried filaments are heated in carbonic acid gas to about 600 degrees centrigrade, whereby most of the organic substances are removed and a filament is obtained which consists of metallic carbide, metallic oxide and metal. It has, however, still a low melting point on account of its metallic impurities, and it is therefore subjected to further reduction in a hydrogen atmosphere, whereby the oxide is reduced to metal.

A very efficient method of manufacturing metallic filaments has recently been evolved by the French Auer Company (Société Francaise d'Incandescence par le Gaz), which aims at the production of filaments for 110 volts and more in one piece and the saving of energy in the process. The filament is spun from the metallic powder mixed with an organic binding substance, wound on a frame of fireproof material and cemented to the same at several places. After being decarbonized to a great extent in the usual manner, the filament is placed in a reducing atmosphere heated by an exterior source to the reducing temperature of the metallic combinations in question. After being subjected to this treatment for some time, the filament becomes electrically conducting and a current is then sent through it which makes it sinter at about 2,000 degrees. The method of winding the filament in a raw state on the frame to be employed in the bulb secures great manufacturing advantages, since the whole filament may be produced in one piece and the difficulty of fusing it to the leading-in terminals is overcome.

This process involves the use of a special furnace, which consists chiefly of a tube of porcelain, clay or metal, the upper half of which is brought to red heat by gas or electricity. A reducing gas is made to flow through the tube, entering it at the top and leaving it at the bottom. The filament is introduced from below and placed in the hot part of the tube by means of rods, which at the same time form conductors for supplying it with current. This hot part of the tube is filled with reducing gases, and when the filament has become conducting therein current is sent through it, which causes it to sinter. As soon as it is sufficiently sintered, which may be ascertained by measuring its resistance, it is removed to the colder part of the tube, where it is allowed to cool to below red heat. This manipulation is necessary in order to prevent explosions of the hydrogen and air mixtures, which would take place if the red-hot rod were suddenly brought near the opening of the tube. Besides, the filament would be oxidized and destroyed by a rapid transfer into cold gases. If the moving of the filament is to be prevented because it might be damaged thereby, an arrangement may be made for moving the tube or the latter may be allowed to cool.

According to observations of the French Auer Company the metal parts of the filament carrier absorb hydrogen, which is detrimental to the burning of the finished lamp. As the occluded hydrogen escapes very slowly from the metal parts, the finishing of the lamp would be greatly delayed, and for this reason the filament is placed in another furnace and brought to red heat in an atmosphere of nitrogen, whereby most of the hydrogen is removed. If necessary, its removal may be completed by exhausting the lamp several times at two-hour intervals.

A further method of manufacturing metallic filaments from carbon-containing substances has been worked out by the Zircon Incandescent Lamp Company and Dr. Hollefreund & Company, Berlin. Its object is the supplementary and complete removal of carbon from the filaments. Their decarbonization is effected by nitrogen, or nitrogenous gases, which are produced in a vacuum from hydrogen and nitrogen—containing phosphorus compounds, as phospham, phosphamides and phosphamine acids, or their sulphates. Phospham (PN_2H) was found to be particularly suitable, as the nitrogen contained in it separates itself in a vacuum at comparatively low temperature and in its free condition combines with carbon into cyanogen or similar compounds. But at the same time phosphorus is liberated, which is capable of binding the oxygen still present.

The process is carried out by adding to the metal powder which is made into a paste in the usual manner, a few per cent of phospham. The more carbon the binding material contains, the more phospham is added to the mixture. For instance, if a paste prepared with tar as binding material contains four per cent of carbon, the effect of the phospham, according to the statements of this firm, will be to free the filaments absolutely of carbon, when they are glowed in a vacuum.

If the filament is to be decarbonized after it is inserted in the lamp, fine phospham powder is mixed with alcohol and applied to it before it is fused in the bulb. While the lamps are connected with the vacuum pump and have been exhausted, the cock between the pump and lamps is closed and the filaments are brought to incandescence by an electric current. This vaporizes the phospham and produces the effect described. In a similar manner the filaments may be decarbonized in a receptacle after they have been dusted or coated with phospham.

The most suitable method of decarbonization by hydrogen and nitrogen-containing phosphor combinations must be that in which the decomposition of the reducing compound takes place outside of the filament. For if the phosphor combination in question, as phospham for instance, is mixed with the raw metal before it is formed into filaments, it is to be feared that it will cause the formation of occluded gases, because the nitrogen liberated from the phospham will have to penetrate the mass of the filament in order to free itself. But many gas molecules will not succeed in leaving the filament, because their pressure will be too low. On the other hand, the gas molecules that do free themselves will produce hollow spaces in the filament and cause a reduction of its cross section, so that the load on it will differ in places, when the lamp is burning.

(*To be continued.*)

Electric Lighting at Buenos Aires Centenary.

It is reported that no less than 391,000 ten-candlepower electric lamps are provided for in the scheme of the director of public lighting at Buenos Aires, Argentine, S. A., for use in connection with the illumination of that city during the Centenary festivities in 1910. The total cost of illuminating the city on the occasion of this fete has been estimated at about $1,000,000.

The Faraday Society.

The Faraday Society, of London, at its annual general meeting held on November 30 last, elected the following officers for the next session (1909-10): President, J. Swinburne; vice-presidents, G. T. Beilby, Sir R. A. Hadfield, Prof. A. K. Huntington, Dr. Ludwig Mond, Lord Rayleigh, Prof. A. Schuster, and Ernest Solvay; treasurer, Dr. F. Mollwo Perkin.

TELEGRAPHY—TELEPHONY, and WIRELESS.

A NEW SYSTEM OF TELAUTOGRAPHY.[1]

BY T. THORNE BAKER.[2]

The Thorne Baker system of telautography, or "telectrograph," as it is called, employs a Caselli transmitter, but the halftone photographs are printed in fish glue on lead foil, and the lines are pressed into the soft metal, so that there is no friction at the style. This tends to give better synchronism, and prevents vibration of the style or tracer. The mechanism of the style is also of an improved type, and the "needle" is so balanced that vibration or chattering is rendered impossible. The receiver is very simple, and is, in appearance, the facsimile of the transmitter. A piece of chemically prepared paper is wrapped around the (metal) cylinder, and the current received is passed through the style into the cylinder, via the paper. Every time current flows, a chemical mark appears on the paper by electrolytic action, as in the Bakewell telautograph. But the paper is sufficiently sensitive to record five or six hundred dots a second; while the receiver is fitted with simple regulating gear by means of which the distortion of the currents caused by their passage through a long-distance line can be completely overcome.

At the sending station there is a revolving metal drum, and a style travels laterally so as to trace a spiral path across it. A single line halftone photograph is wrapped round the drums, and the lines in the picture act therefore as interrupters of the current sent into the telephone line. At the receiving end, the style feeds the paper with current, decomposition is effected, and a dot appears each time the sending style comes in contact with the lead foil, i. e., when it is between two lines. A weaker current also flows through the style and drum in the opposite direction.

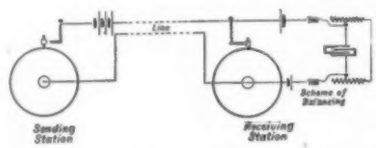


DIAGRAM SHOWING CIRCUIT CONNECTIONS OF TELECTROGRAPH.

The battery used to supply this current is divided into two components. In series with each is an adjustable inductance with soft-iron core and an adjustable resistance, one end of each resistance being joined. One end of each battery goes to the receiver, so that the whole arrangement acts as a shunt on it, or on the line. Between the sliding contacts of the resistance is a variable capacity.

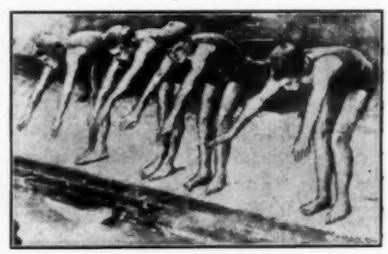
It is evident from line tests that when an intermittent current with a period is transmitted, such as happens in the transmission of a halftone photograph, secondary surges are set up differing in phase from the original waves, since, without the line compensator, there is an elongation of each dot, gradually tapering off in the manner of a wave-train. By sliding along the various contacts in the "balancer" it is easy to make the dots come crisp and clear, so that the receiver, ordinarily sluggish and completely useless on a long line, becomes exceedingly rapid in action.

The ordinary receiver as used by Bakewell would be valueless for the work.

The necessity for, and great value of, the variable condenser, only became apparent when I began to transmit pictures by the telectrograph from Paris to London, where we have the submarine cable to deal with. I had previously made it a part of the balance from theoretical motives, but it appears to be essential when working over a distance of any magnitude, as was the case in transmitting the accompanying pictures.

Artificial Line.

Paris to London.



Manchester to London.

REPRODUCTIONS OF ACTUAL TELECTROGRAPHIC PHOTOGRAPHS.

1 From a paper presented before the Royal Society of Arts, London, Eng. This account is from the *Journal* of the Royal Society of Arts, November 26, 1909.

2 Photographic Expert of the London (Eng.) *Daily Mirror*.

The photographs were kindly furnished by Mr. Thorne Baker.

St. Louis Interests Hold Continental Lines.

The brewing interests of St. Louis are said to be the heaviest stockholders in the Continental Telegraph and Telephone Company. This company has contracts on telephone wire mileage representing an investment of $250,000,000.

ECONOMY OF PROPER TELEPHONE ENGINEERING.[1]

BY KEMPSTER B. MILLER.

There should be no need of a paper on this subject. The fact that proper engineering practice is absolutely necessary to the attainment of real economy in the telephone business ought to be as evident as the fact that good management is necessary. Yet there are those who doubt and even deny the necessity for any engineering advice at all. The fact is good engineering and good management must go hand in hand—neither alone can achieve lasting success. The truth of this statement, which is so simple as to be axiomatic, has not generally been recognized among the rank and file of telephone operating companies; and the failure to appreciate the value of the services which a good engineer may render is one of the principal causes of the condition in which some of the telephone companies find themselves today.

Let me first point out my idea of what the relation of the telephone engineer to the telephone organization may be, and suggest some of the duties which he may be expected to perform. There is no time in the history of a telephone enterprise that the service of a trained engineer is not needed. At the inception of the project, before the construction is begun, he may be called upon to make a preliminary examination or reconnoissance in sufficient detail to make a preliminary estimate, not only of the extent and cost of the proposed plant, but of the gross revenue, expenditures and net revenue. This preliminary engineer's report should form the basis of the financial scheme of the proposed company, and it should serve as a guide in helping capitalists to make up their minds whether to make the investment or to keep out of it. Capitalists in other lines of public service work will usually not invest their money without the advice of competent engineers of recognized standing. Why should they be asked to do so in telephony? Certainly it is not because telephone enterprises are not capable of standing rigid scrutiny if properly planned and carried out. So much for the engineer's relation to the promoter or proposed investor.

After the project has been financed and before and during construction the engineer's services are required to lay out and supervise the installation of a plant that will, so far as possible, make the very best use of every dollar that is spent in its construction. There is an impression among some that the whole tendency of engineering during construction is to build with reckless extravagance on the theory that the most expensive materials and methods of construction are not good enough. These people have the wrong idea of the function of the engineer. An engineer who builds extravagantly is as bad as one who builds too cheaply. Superlatively fine construction, involving great expense in purchase of materials and in the carrying out of methods where a cheaper material and less costly methods would do nearly or quite as well, may result in the building of a monument for the constructor, as has often been remarked, but the monument to my mind is in the nature of a tombstone.

Not only should the engineer plan the proper kind of a plant, a plant that will be able to give adequate service, that will provide facilities for future growth at a minimum outlay of expense, that will present minimum depreciation and other fixed charges and maximum revenue, but he should during the entire construction period be the right-hand man of the president and the board of directors and the constant adviser of the superintendent of construction.

As related to the general manager of a plant that is in operation the engineer should be the adviser on all technical questions that may arise, in the departments relating to the plant, to the traffic and to the commercial side of the business. In those larger matters of franchise relations, rates, substantial extensions and reconstructions, and radical changes in methods or apparatus the engineer can usually be consulted with great advantage. I do not mean by this that the engineer is to be considered a dictator of the financial as well as the technical policy of the telephone company, but I do mean that he should at least be consulted in the fiscal as well as technical affairs of the company, in order that the determination of important policies, such as the fixing of rates and the determination of the amount to be charged off for depreciation, may not be made upon a false and unsound basis.

The engineer should work hand in hand with the superintendent of traffic to produce those results predicated by him in the design of the plant, to meet the problems incidental to growth and to properly plan the modifications required to meet unforeseen distortions in development. His relation should be no less close with the work of the superintendent of maintenance to the end that the apparatus and material that is constantly being built into the plant shall be properly employed and shall serve economically the purposes for which they were intended, and to the further end that problems brought about by the advancement in the art shall be intelligently solved from the standpoint of economy and operation.

A close relationship should exist in a going plant between the engineer and the superintendent of construction, in order that the extensions shall be wisely correlated with the distribution as determined by the development studies, and in order that the installation of additional plant shall be in accordance with the specifications prepared by the engineer. In his relation to the contract department the engineer may point out the lines, locations and classes of service in which development is desired, and by the use of which increased revenue may be obtained with minimum expenditure. On the other hand the contract department should so organize its work that the engineer may at all times be able to secure information as to probable growth and local demands in the various sections in order that he may plan the proper facilities for meeting these demands.

Lastly, the relation of the engineer to the auditor is not the least in importance. He should confer with the auditor as to the form of bookkeeping to the end that the books of the concern may show clearly and accurately: First, the general financial results of the investment; second, the particular returns from the various classes of service; third, the particular expenses of maintaining and operating the various component parts of the system; and fourth, certain of the fixed charges, such as that for depreciation, reserve or sinking fund, the proper determination of which is almost wholly an engineering problem, and the neglect of which is in my belief, one of the principal causes of the bad condition of some of the independent companies today.

[1]Paper read on December 7 before the annual convention of the International Independent Telephone Association, at Chicago, Ill.

In concluding this part of this discussion, concerning the relation of the engineer to the telephone organization, I will say that the opinion sometimes expressed, to the effect that the engineer is merely a man possessed only of technical knowledge concerning physical things, is entirely erroneous. He must be that, but what is even more important he must have the ability to consider broadly business affairs with sound judgment so as to weigh the economic advantages of the various methods of making and doing things. The function of the engineer is broader than that of telling you how to mix your concrete.

Let us consider now, briefly, the past, present and future of telephone engineering as related particularly to independent telephony. It cannot be denied that the early history of the independent telephone business is one of much promotion and little or no engineering. There have been exceptions, of course, and these stand out in bold relief against the background of plants that were robbed at the outset, and have only survived by virtue of the wonderful, inherent vigor of the telephone business. The manufacturers have been the exceptions to the general rule. They have done splendid service and the development of their respective lines of apparatus is ample tribute to the energy and skill of their engineers. But only a relatively small portion of the cost of a plant is represented by telephones and switchboards. From two-thirds to four-fifths of the cost of a telephone plant is in the buildings, conduits, poles, cables and wires, and the distribution of these and the method in which they were employed have frequently been left to the tender mercies of one whose previous experience had extended no further than the foremanship of a construction gang.

I was recently called upon to quote a price for the engineering of a new telephone property in a town of considerable size. The figure I mentioned was met with the statement that the total cost of all the engineering work on a certain larger plant in which this gentleman was interested was only about a quarter of that mentioned by me. I made no reply but I might have informed this gentleman that I could point to places in this plant of his where fifty-foot pole lines, to which there was not a single wire attached, had long been standing on certain streets; that in one place he had an eighteen-duct conduit containing after some years of operation of the plant only a single cable; that in other places he had ten-duct conduits that were already full of cables with no provision for growth; that his facilities in certain parts of the town were planned on an extravagant basis while those in others were wholly inadequate, and that his central office was so far removed from the true center of the property as to have caused a useless expenditure of money which alone would have paid for proper engineering many times over.

I can point to places, and so can most of you, where the lack of engineering services at the time of construction of the plant has resulted in a plant which cost too much money and which was incapable of properly serving its purposes, and I can point to many cases where the lack of proper engineering talent, or the absence of co-operation between the engineering and fiscal departments have resulted in such improper methods of maintenance, operation and accounting as to make all the difference between a successful concern and a failure.

Just one more thought concerning the lack of engineering in the past. I venture to say that the telephone exchange system which has anything like complete records, either in maps or in other forms, is the exception rather than the rule. I know of one large property embracing a large number of local exchanges and connecting lines, where there was not to be found a single local map of any one of the cities in which the company operated, to say nothing of having the physical property of the company located on such maps. As a result of this valuable property is sometimes actually lost, extensions are often made for reaching certain districts where the records should show that the facilities are already at hand, and, lastly, in times like this, when consolidations, combinations and purchases are the order of the day, the actual extent of the plant cannot be shown to an intended purchaser and an appraisal of its value can only be made by the engineer being compelled to actually go out and hunt for the property.

The lack of proper engineering in the past has brought down to us today a great many plants for which reconstruction and general reorganization is absolutely necessary. The neglect to make provision for the inevitable depreciation has led to a false system of accounting and a false showing on the books. The improper initial design and faulty method of carrying out extensions, together with the usual rapid growth of independent systems, has led to a condition where the limit of capacity of the plant is reached and where further facilities cannot be provided without undue expense in first cost and maintenance.

The engineering problem that confronts us today is therefore mainly one of reconstruction rather than new construction. The cities and towns which have no independent telephone plants are comparatively few. In some plants that exist, reorganization, rehabilitation, and reconstruction must be the order of the day.

The problem therefore first involves a study of the ways and means of securing the necessary funds. This may and is likely to involve the combining of separate and scattered units under a single organization where a better grade of executive and engineering talent may be employed in view of the larger interests involved. Concerning such combinations, little need be said in view of the developments that are now so rapidly going on about us. In making them, however, the services of a competent, unbiased engineer could with great profit be employed to definitely determine the value of the physical properties, and if necessary such work may be combined with a study and recommendations based thereon, concerning the general betterment of the operating and construction methods. It is seldom that such properties may be brought together under one management without the possibility presenting itself for a distinct betterment of the earning powers of the combined properties with the outlay of a very small amount of money, under such proper engineering. Often the stringing of a comparatively small amount of copper wire on poles already existing will greatly facilitate the handling of heretofore neglected long-distance business, thus increasing the earning power of the properties and enhancing the general value of the service to its patrons.

If the general situation in which a given operating company finds itself is of such a nature as to not make it capable of a proper showing to attract additional capital, then the problem of the engineer in connection with the management is to devise a plan of increasing the revenue or decreasing the operating expenses, or both, perhaps by reaching out for a certain class of subscribers that may be added with a minimum expenditure, or raising rates, or employing a more economical operating system. In such cases the engineer in planning for the betterment of a system is met with the necessity of bringing it about gradually rather than making a single drastic reconstruction. Some times small amounts of capital may be secured on proper showing, where a larger amount necessary for complete reconstruction would not be possible. For such cases the engineer should make a definite plan for the expenditures of the moneys received from outside sources, or from the earnings of the plant itself, so that the first expenditures will afford a remedy for the most urgent needs of the company, new construction work of less importance being left for future years or until such time as the finances of the company shall warrant it.

In making such reconstruction plans, whether for a complete single reconstruction or a gradual one, the first and most essential requirement is the making of a proper development study. I say the first and most essential because the development study forms the very foundation upon which any extensive plant engineering work must rest, whether of construction or reconstruction. In spite of the fundamental necessity of the development study, it is undoubtedly true that a very large majority of the independent plants of this country have been planned and extended without any development study whatsoever, and that a large number of those in charge of such work have never even heard of the term and are unacquainted with its meaning.

The development study is no mysterious thing, but it does require time, patience and good judgment to properly carry it out. When completed it should show for a given city or community the probable number and kind of subscribers that will be available in the immediate future in each block or smaller unit of area of the city, and it should also show what in the best judgment of the engineer the number of subscribers in each corresponding area will be at the end of some future time, say at the end of five-year and twenty-year periods from the date of the study. With such a development study before him the engineer can intelligent proceed to the laying out of his plans. Not wishing to tear up the streets every time he wishes to add an underground cable, he will plan his conduit system to meet the demands of perhaps the twenty-year period, as shown by his development study. He will lay out his pole lines, as required by the present system, with the view of extending them as required by the growth of the system to the ultimate capacity. He will lay out his cable plans for the present and the immediate future and will so arrange his cable distribution and terminals as to provide ready relief by drawing in of new cables and by extending them into areas as demanded by future growth. If the plant is well engineered it will provide facilities for the immediate fulfillment of the requirements of the present development and will provide for the addition of further facilities at minimum expense as they are demanded by the growth of the service. A plant so engineered and constructed may be operated and maintained at minimum annual cost, and it may be added to from time to time up to its ultimate capacity with the expenditure of a minimum amount of money. Such a plant, providing adequately for the present and for the orderly carrying out of the plans for growth, will largely preclude the necessity for a general period of reconstruction such as now confronts so many companies.

But having attended to all the engineering needs demanded by the present, it must not be supposed that the task of the engineer has ended. Good engineering like almost every other field of activity demands keeping steadily at it. Because a plant has been carefully planned for the future as well as the present, it does not follow that the tentative plans now made for the future must be followed to the bitter end. Witness, for instance, the San Francisco earthquake, which, of course, is an extreme case used merely to illustrate the point. The local conditions in any community are subject to change in unforeseen and unexpected ways. The establishment of a new industry in a given locality which attracts large masses of people to that neighborhood sometimes cannot be foretold. The extension of the business district of a city into a district formerly occupied only by residences, or the springing up of a new business district in a residential section, are among the many things which do and will happen to change the best laid plans of the engineer. A development study made now and showing the best judgment of the engineer as to the conditions that will exist twenty years from now is of inestimable value now, but who would think of considering it as authoritative when the twenty-year period shall have elapsed.

In conclusion, it is my belief that the work of the engineer has received too little consideration by independent telephone companies at large in the past, that had it received more considerable the situation in which certain companies find themselves would be better than it is today, that if independent telephony is to gain ground in the future it can only be done by the combination of sound, broad-gauged business management and sound, broad-gauged engineering policy.

Chicago Electric Club.

Following the regular weekly luncheon of the Chicago Electric Club on Wednesday, December 22, J. B. Ware, Grand Rapids, Mich., secretary of the National Independent Telephone Association, addressed the club on the subject of the "Telephone Development and the Benefits of Competition."

The address of Mr. Ware, an enthusiastic worker for the Independent companies, was particularly interesting, coming as it did one week after the address of President B. E. Sunny of the Chicago Telephone Company before the same audience. Mr. Sunny spoke in favor of the telephone companies having a monopoly on the business, and Mr. Ware was equally as enthusiastic regarding competition, making this the actual subject of his talk.

To illustrate the growth of the Independent Telephone companies and to emphasize the results of competition in the telephone industry, Mr. Ware briefly reviewed the early telephone history. He said that the conditions which existed in Chicago in 1879 were the same in all large cities, both the Bell Telephone Company and the Western Union Telegraph Company

being in the field. In the fall of 1879, however, the two companies entered into an agreement wherein the Western Union was to withdraw from the field in consideration of receiving twenty per cent of the yearly income of the Bell companies. In 1880 the American Bell Telephone Company was organized, and secured entire control of all telephone patents existing at that time.

Mr. Ware asserted that the growth of the telephone industry decreased considerably during the succeeding years showing in 1894 a gain of only 81.5 per cent. In that year, however, the majority of telephone patents expired and the Independent Telephone companies entered the field. As a result of this the three succeeding years showed gains of twenty-one, thirty-one and thirty-six per cent increase respectively in the number of telephones, in use.

To show the remarkable growth in the number of Independent telephones as compared with the Bell instruments the speaker referred to the Government report of 1907, in which the Bell interests were credited with 3,000,000 instruments, and the Independent companies which started in 1894 with a like number. Comparisons were also made in the various states showing the Independent companies to have developed to a much greater extent than those of the Bell, excepting in the larger cities. As an example, the states of Illinois and Indiana were shown to have 500,000 Independent telephones against 206,000 Bell telephones.

In conclusion it was the opinion of Mr. Ware that no one monopoly will develop to its fullest extent such a business as the telephone industry, and that in this case as in all others competition is probably the only way of securing for the public regulation in rates and efficiency of service.

Transoceanic Wireless Telephony.

According to a recent cable message from London, the London *Daily Mail* states positively that a wireless telephone station is being established on the Mutual Life Building in New York city, with a view to speaking wirelessly with the new wireless station at the Eiffel Tower in Paris. Inquiries at the offices of the Mutual Life to confirm or deny this report were unsuccessful.

Tests with the Egner-Holmstroem Microphone.

After long experimentation two Swedish engineers, Carl Egner and J. Kunnar Holmstroem, have succeeded in constructing a microphone which surpasses in strength all others heretofore employed and is capable of withstanding heavy currents without undergoing any change. For reasons of patent protection the construction of the instrument is not described, but the results of various tests carried out during the past six months are published. In order to measure the energy of the alternating current produced by the microphone a resistance of 1,000 ohms, free of capacity and induction, was inserted in the circuit of the telephone apparatus. The intensity of the alternating current produced in the circuit by a constant sound of medium height emanating from a siren in the middle of the room and taken up by the diaphragm, was measured by means of a vacuum thermo-cell. The energy corresponding to the sound vibrations given by the new mirophone and by two others that are extensively employed in Sweden were as follows:

	Intensity, Tension and Energy of the Alternating Current.		
Microphone.	Amperes	Volts	Watts
Microphone No. 1.....	5,5 10^{-3}	5,5	0,03
Microphone No. 2.....	8,3 10^{-3}	8,3	0,07
New microphone.....	33,0 10^{-3}	33,0	1,09

Among the various long-distance experiments described there was official test made by the Swedish Government, in which several telephone lines constituting a total length of 3,189 kilometres (with copper conductors 4.5 millimetres in diameter) were joined together. The total damping coefficient of this line at an average frequency of 800 per second was $\beta = 6.05$. While speech was transmitted strongly and clearly by the Egner-Holmstroem microphone, no sound was audible at the distant end when the ordinary apparatus was used. The new microphone has also been tested in wireless telephony, instruments capable of permanently withstanding a current of ten to fifteen amperes being employed for this purpose. In experiments between two wireless stations in Denmark operated under the Poulsen system speech was transmitted very distinctly over a distance of 280 kilometres. In this instance the microphone was fed by a high-frequency current of about six amperes.—*Abstracted from La Lumiere Electrique (Paris), November 20 and 27.*

RESULTS OF ELECTRIC TRACTION EXPERIENCE ON ENGLISH RAILROADS.

BY OUR BRITISH CORRESPONDENT.

The presentation of three interesting papers, dealing with the experience obtained from electric traction tests on English railroads, resulted in interesting discussions at several recent meetings of the premier engineering institution in England, namely, the Institution of Civil Engineers. The titles of the papers were as follows: "The Single-phase Electrification of the Heysham, Morecambe & Lancaster Branch of the Midland Railway," by J. Dalziel and J. Sayers; "The Equipment and Working Results of the Mersey Railway Under Steam and Under Electric Traction," by J. Shaw; and "The Effect of Electrical Operation on the Permanent Way Maintenance of Railways as Illustrated on the Tynemouth Branches of the North Eastern Railway," Dr. C. A. Harrison.

In their paper, Messrs. Dalziel and Sayers explain that the choice of the Heysham section of the Midland line for a more or less experimental electrification was partly due to the fact that power could be supplied from an existing power station at Heysham. Though the traffic is light it is long-hour throughout the year, and, consequently, is expensive to operate by steam, so that there was scope for saving in working expenses; also the summer traffic is heavy and liable to congestion, two of the stations being terminals, and there being a considerable local traffic between Morcambe and the third station, Lancaster, which tends to congest the main line trains. In describing the equipment, the authors gave some notes as to the effect of lightning and atmospheric electricity on the overhead wiring, of bond resistance, of the impedance of the return rails, of the paths of the return current, and of the effect of the alternating current on telegraphs and telephones. They also showed how the alternating current for the infrequent service is obtained from the existing direct-current generating machinery; how the heavy traction "peak" loads are arranged to be dealt with from the comparatively low capacity power station; and how the two equipments (Siemens and Westinghouse) on the

coaches are arranged for working from the same master controller and on the same train. The information regarding tests of the equipments, consumption, motor characteristics, power-factors, and the performance of the motors while at work was very fully given, but unfortunately any publication by the press of more than the merest outline of the papers read before this Institution, prohibits us from saying much here at the moment. The motor cars are required to work very similarly to locomotives, and take over daily from steam locomotive trains totalling up to a weight of 190 tons, which is 125 per cent over the loading specified to the contractors. The authors particularized the difficulties under which it has been at various times alleged that single-phase apparatus labors, particularly in respect to its asserted unsuitability for high-schedule-speed, frequent stop, suburban and interurban traffic necessitating high accelerations, and they proceeded to prove from the results of special tests, made with a view to ascertaining the accelerating capabilities of the Heysham equipments, that single-phase apparatus is not only equally as capable of working such services as direct-current apparatus, but that the weight of the single-phase trains is only a very small percentage greater than that of corresponding direct-current trains, and that the energy consumption is appreciably less. The paper also gave results in service, and an indication of the probable cost per train mile of such a service, and the mileage life of the various wearing parts, including bows, commutators, brushes, bearings, contactor contacts, wheel tires, etc.

Mr. Shaw in his paper compared the equipment and working results of the Mersey tunnel railway when operated by steam and electricity. The great improvement that has been effected on this system since electrification is a well-known story, but Mr. Shaw gave many figures as to working costs in both the locomotive and the engineering departments. He said that the departments most directly affected by the substitution of electricity for steam were the locomotive and carriage departments. Under electric working on the Mersey line these have been reduced from .2 cent to .17 cent per ton mile. With electric traction one pound of fuel, costing $2.10 per ton, moves one ton of load 2.29 miles at an average speed of 22.25 miles per hour, whereas with steam, the same quantity of fuel, costing $4.00 per ton, moved the same load 2.21 miles at an average speed of 17.75 miles per hour. The effect of electric traction on the maintenance of the permanent way had been to reduce the cost of maintenance per ton-mile from .04 cents to .16 cents, or by .02 cents per ton-mile. As regards the life of rails under the two systems, the average rolling load over the track before the rails require renewal is increased from 32,000,000 tons to 47,500,000 tons. The substitution of electrically-driven pumps for the working of the hydraulic lifts has decreased the cost per lift-mile from $1.75 to 62 cents, a decrease of $1.12 per lift-mile. The effect of electric working on the working results has been to decrease the cost per ton-mile thus: (1) Total cost of working and maintaining the whole of the locomotive and engineering departments, from .46 cents to .30 cents, a decrease of .18 cents; (2) total costs of the railway, including general charges, etc. (but exclusive of interest on additional capital for electrification), from .68 cents to .48 cents, a decrease of .20 cents.

The average speed (including stops) has been increased from 15.6 to 19.9 miles per hour and the number of ton miles per annum from 43,000,000 to 67,000,000, while the total expenses per ton-mile, after allowing interest on additional capital for electric works, have been reduced from .68 cents to .58 cents.

The paper by Doctor Harrison dealt with the electrified sections of the North Eastern Railway, a section seventy-five miles long, including sidings; the average distance between station stops is 1.25 miles; operated by a 600-volt current taken direct from conductor rail by shoes fixed on cars, the return current passing along the track rails. The details of the system, which has been running since 1904, are familiar to our readers, but the authors dealt with the effect of electric traction and the cost of maintenance, etc. For the information of those who may desire to refer to the paper in its complete form when published in the Proceedings of the Institution of Civil Engineers, it may be mentioned that Doctor Harrison described the contact shoe, bonding, anchorage for preventing the "creep" of the rails, and the track cable terminals. He also compared the train service under steam and electrical operation, respectively. Although the train-mileage has nearly doubled, the car-mileage and ton-mileage are slightly less under the new conditions. He dealt with the movement of wear on permanent way, which, although greater under electric traction at points and crossings than with steam operation, is only slightly increased on the ordinary running line, either on the straight track or on curves. The methods of inspection of insulators, bonds and electrical connections, and also the difficulties encountered owing to the presence of snow or ice on the conductor rail, which are overcome by the use of special ice scrapers fixed on the car, were referred to. There has not been a fatal accident due to electric shock to any of the railway company's employes, and serious injury due to shock has been very exceptional, the men being provided with insulated tools, rubber gloves, and mats for their protection. Fatal accidents through shock that have occurred on the electrified lines have in all cases been due to trespass.

A much greater amount of work is now done at the platforms at the central station, as there are no engines to attach or detach. The trains can be discharged and reloaded for a return journey in two minutes, and they are all dealt with from three platforms. The signal operations are reduced by one-half.

The high acceleration realized was stated thus: (1) Time occupied in running round trip from the central station to Manors North Station, with steam train, sixty-eight minutes; with electric train, fifty-eight minutes (stopping at all stations).

(2) Time occupied in running from central station to Tynemouth station with steam trains, thirty-five minutes; with electric train (stopping at all stations), twenty-nine minutes.

(3) Express steam train from central station to Monkseaton, via Wallsend, thirty minutes; express electric, twenty-five minutes.

Doctor Harrison gave an estimate of the annual cost of renewals, and he also showed that it would have been impossible to carry by the old steam service the number of passengers that are now being electrically conveyed.

A CENTRALIZED TESTING ORGANIZATION.[1]

BY JOHN G. CALLAN.

In the purchase and administration of supplies, street railroads and analogous enterprises are confronted by the same problems which have driven the several governments and the progressive large railroads and industrial plants to establish standardizing and testing laboratories, to buy wholly on specification, verifying quality of shipments by test, and to keep systematic account of every item consumed.

The principal valid reason of general application which has deterred street railroads from adopting this solution is the practically prohibitive cost of establishing, manning and operating a laboratory of such scope and personnel as to be of any real use. Compromise attempts to use slight equipment and an inexpensive staff—almost never adequately trained and experienced—usually cost surprisingly, achieve little, and in their eventual abandonment discredit the whole idea. With a road of moderate size, any given element of the testing equipment is idle most of the time, and the man in charge is most often employed on matters wholly foreign to his training. When we add to this the fact that specifications based on this man's inevitably meagre experience and obscure reputation would possess doubtful value and command scant respect, it ceases to be remarkable that most managers have chosen the other horn of the dilemma and continued to buy on the word of the seller, well knowing that this course is not ideal, but yet unwilling to flee to troubles that they know not of.

The logical way of handling this element of the business lies in quite another direction—the support of a thoroughly adequate laboratory by a considerable number of roads or similar enterprises, and its employment by each road or company for exactly and only such part of the time as is necessary. In this way there is available for each road at any time a staff ample in numbers and equipment and rich in pertinent experience and in the specialized technical skill which experience alone can impart—and this at a minimum of expense to each.

1 Abstract of a paper read before the Central Electric Railway Association, November 18, 1909.

This laboratory might conceivably be organized and operated by an association of street railways, by the state, or by an educational institution; or it may be established by private enterprise and its services in such amount as required be contracted for by individual roads or groups of roads. For several reasons the course last named offers the greatest guarantee of an organization of that vigorous and alert character and keen initiative which insures results.

The work that such a commercial laboratory will be called upon to do will usually fall within the following groups:

1. Fuel Engineering: Choice of coal; specifications; tests; fire room practice. 2. Lubrication: Lubricated parts. 3. Specifications backed by tests and inspection for all important supplies. 4. Electrolysis and corrosion.

FUEL ENGINEERING.

In buying coal the essential purpose is to buy power, and the proper criterion is the number of horse-power hours bought for a dollar, firing cost included. This is obvious enough, but none the less numberless purchasers, even where coal is the largest single expense item, buy that coal by methods which invite and obtain results materially inferior to those easily attainable and daily secured by the Government and by other consumers using scientific purchasing methods. It is about as easy to follow the right procedure as any of the numerous wrong ones, but even engineers fall into ruts and conventions;—it has not been customary to seek out economies in the fire room; and slack surveillance, guess work and wasteful methods have intrenched themselves there until they have almost achieved the dignity of standard practice. The history of electrical generation of power is marked by the succesive overthrow of other similar bad traditions and illogical practices, and we may venture to hope that fuel engineering is on the way towards a rational basis.

In the absence of specification buying, the purchaser has much justification in paying this additional sum for a trade name since then his only reliance is on the reputation of operator and dealer. For example, coal from two adjacent veins, one with a "bone," the other without, or "run of mine" from the same vein, in one case "shot off the solid," in the other properly undercut, will differ in value to so considerable a degree that the risk involved in excursions into unknown and unanalyzed brands renders experiment very doubtful and hazardous.

That coal, at once a natural product of inherent variability, and an expense item of the first magnitude, should ever be bought without accurate knowledge of its worth, constitutes an anomaly which does not fail to cost the consumer dear.

In the fire room again there is a chance for astonishingly wide differences in production of power resulting from combustion of the same amount of a given coal, and in addition to this, the combustion chambers, grates, draft and like elements may cause a plant to be very ill suited to one kind of coal and well adapted to another.

The prevention of scale and corrosion in boilers is frequently a matter of grave importance and affords a problem always amenable to attack by a chemist skilled in this particular art. The percentage profit on proprietary boiler compounds is usually exceedingly high, and while many are good many others are practically valueless. In a lesser measure corrosion of surface condenser tubes, erosion and fouling of turbine blades and like problems afford an opportunity for the mechanical and chemical engineer to save money.

LUBRICATION—LUBRICATED PARTS.

In the matter of lubrication again the basis of maximum economy is that founded on specifications prepared by an engineer familiar in detail not only with the technique of oil and grease manufacture but also with the requirements and results in numerous similar cases.

At the same price and for the same service are sold oils of widely different lubricating value, and conversely substantially identical oils under different names sell at widely different prices; while particular brands are insistently and successfully heralded as exclusive possessors of the most extraordinary properties.

When it is realized that a simple change of gear case grease has in at least one instance practically doubled the average life of pinions on a high-speed interurban road, it becomes clearly apparent that lubricants can-

not be chosen at random, while, on the other hand, an examination of current prices for absolutely interchangeable oils shows that an excessive outlay is not needed to secure a good lubricant, and that a large percentage of the expenditure can easily go for the trade name.

Due attention to feed, filtration and to accurate analysis and record of lubrication cost always pays. They are too often neglected.

It may broadly be said that no oils and few greases possess abstruse or recondite properties and that they are always a proper subject for purchase on straight specification basis.

Babbitts and bronzes for bearings require specifications checked by analysis and occasionally microscopic examination of samples, but they further require on the part of the purchaser expert broad experience and a knowledge of foundry practice, since a number of bronzes of like analysis may possess rather widely different characteristics, and elements are often introduced for deoxidizing, purging, and the like, which do not finally appear. A properly qualified expert allows for these and bases his judgment on experience as well as analysis.

It is not very unusual for one bearing metal to show five times the wear under like conditions that is found with another of about the same cost.

SPECIFICATIONS AND INSPECTION.

In buying supplies on specification and determining quality of shipments, judgment must again be coupled with specialized skill. Certain materials can be fully determined as to value by laboratory tests, while others require careful observation and tabulated comparison. For example:—steel rails, cement and trolley wire may properly be bought on straight physical and chemical specification backed by brief and summary tests and inspection, while finishing and insulating varnishes, and the like, require prolonged tests closely approximating service, or service itself under systematic observation. This latter will be true wherever the same materials differently treated may produce widely different results and where, at the same time, wear is essentially a prolonged process of aging. Obviously here experience and knowledge of the trade are of paramount importance, and the properly qualified expert should be able to furnish such knowledge and experience quite as much as to make analyses.

Paints exemplify a class of materials occupying an intermediate position, where analysis and a knowledge of the trade are co-ordinately important. The best paint is invariably the cheapest, but the most expensive is not always the best, nor is the paint best for wood necessarily at all suitable for iron.

Insulating compounds for fields and armature coils vary from excellence to comparative worthlessness, and the prices of those possessing value are by no means a measure of that value. Also there is a truly extraordinary amount of mis-information current on this subject, and the short-cut tests and criteria most in vogue are for the most part not only valueless but wholly misleading.

Preservation of wood by coal tar creosote, bichloride of mercury, zinc chloride, petroleum residue or other agents deserves distinctly more attention than is usually accorded it. In very many cases it will be found that, figuring current interest rates, and probable cost of replacement at probable replacement date, this expenditure is a very profitable one.

Structural material, cement, rails, special work, car wheels and axles, motor gears and pinions, brushes, springs, brake shoes, trolley wire, ears, insulators and other overhead material, trolley wheels and harps, rail bonds, poles and ties, cables, and small supplies such as packing and solder should all be strictly on a specification basis with analysis and inspection to check deliveries.

ELECTROLYSIS.

The subject of electrolytic corrosion is certain to become more prominent with lapse of time, and as in other matters affording opportunity for agitation, this prominence is likely to be sudden and somewhat irrational. Those roads will be in the strongest positions which have resorted early to all reasonable palliatives. There are occasionally geographical arrangements of trackage and extraneous conductors which concentrate electrolysis at certain points, and in such cases it is often necessary to resort to expedients other than good bonding. Relay switches or aluminum cells, and suitably placed earth or sea plates each have their proper function, but all require skillful application.

There can be no valid question of the financial wisdom of fuel engineering, specification buying, system in lubrication, scientific attention to boiler corrosion and scale, electrolysis and the other things set forth above. Most roads indeed make some more or less perfunctory effort to attend to some of these things now, often by employing a man to look after some element that has come up for attention and giving him a vague roving commission to care for as much more as he can.

Now obviously the man that supervises the firing must know more about firing a boiler than the fireman—not only theoretically but in the practical way that spells results. Similarly the man who draws specifications on coal must know the coal fields, methods of mining and preparation, the technique and personnel of the trade, besides being a coal chemist; and so with oil, wire, rails, paints, preservatives, and all the rest. One man who could make himself felt in all these fields may exist, but no moderate sized road could profitably pay for all his time, nor is that more necessary even with the largest roads than that each family should have a private and exclusive doctor, dentist and occulist. Carrying the somewhat absurd analogy further, we may imagine the lame character of specialized skill which might be expected from such a family attendant, especially if he filled spare time with a bit of barbering, manicuring and chiropody.

Clearly this is one of the fields where the engineering is best done by an organization larger and better than any one road can support, and impartially at the service of all, whether maintained by the state, by a college, an association of operators, or, probably best of all, by enlightened private enterprise.

A New Fare Box for Pay-as-You-Enter Cars.

A new fare box for pay-as-you-enter cars has made its appearance in New York. It differs in almost every way from the usual contrivances of its kind. In the first place it not only collects and registers nickels, but gives the conductor access to the cash, after it has been registered, and thus renders it unnecessary for him to fill his pockets with change before he starts out on his trip. In the second place, the new fare box enables the conductor to detect mutilated and counterfeit money; for the coin slides down a glass-cov-

ered chute and is therefore visible. If the conductor discovers that it is a counterfeit, the coin is mechanically dropped into a special receptacle and returned to the passenger. If the coin is good, it is registered and caused to drop into a cash drawer.

Although it is not likely that a dishonest conductor would attempt to abstract so small a sum as a nickel by turning the box upside down, so that the nickel would run out, an automatic gravity closure has been provided which effectually blocks the chute if the attempt should be made, so that the fare must pass through the apparatus in the regular way.

The width of the chute is just large enough to accommodate a good nickel. A larger coin cannot enter, and a smaller coin is mechanically returned by the machine. Each conductor is held responsible for the fares registered. Although he has access to the cash collected, the amount turned in must be the amount recorded. Thus a very simple and effective check is provided, without the necessity of giving the conductor a large amount of small change with which to start his trip. The boxes are made of a special composition of metals and weigh only ten pounds.

Sale of the Toledo & Indiana Electric Railway.

A bitter fight is anticipated at the coming sale of the Toledo & Indiana electric railway, which will be again offered at auction by Receiver Niles at Toledo, Ohio, on January 18. Indications point to four active bidders for the property, the majority bondholders, the minority bondholders, the Knickerbocker Trust Company of New York, and the Ohio Electric Railroad Company. The property is now appraised at $920,000, and was sold a short time ago for $1,006,000, but the sale was set aside by Judge Manton for irregularities. It is now expected that it will bring a better price.

To Operate Electric Express.

The contract under which George A. Evans has for several years operated an electric express system on several of the suburban trolley lines radiating out from Hartford, Conn., expires January 1. The agreement will not be renewed, as the Connecticut company has decided to take over the express service and operate it itself.

Public Service Corporation Franchises.

In a recent newspaper interview President T. N. McCarter of the Public Service Commission of New Jersey said regarding franchises of public service corporations, that the so-called short-term franchise for twenty years or thereabouts is of no benefit to anybody, including the public. In suburban and rural communities a property cannot be financed upon it, and it is doubtful if it can be in urban communities. Moreover, the experience of expiring franchises, notably in Chicago, has demonstrated that for years approaching the end of the period there is involved a deterioration of plant, equipment, and service which works to the direct injury of the public.

He was in favor of a perpetual, or very long right of operation, providing, however, for certain stipulated periods when the conditions under which operation takes place shall be readjusted by agreement between the municipality and the company, if possible, and if not, settled by arbitration. This has always seemed to solve the problem of financing, and to offer fair and reasonable protection both to the municipality and the corporation. Where urban properties are to be financed solely by sale of bonds, it can probably be done upon a franchise of fifty years' duration, if the mortgage securing the bonds contains an adequate sinking fund provision.

New York Lighting Contracts Mixed.

According to recent newspaper reports the officials of the gas and electric companies of New York city have been making determined efforts to balance their accounts with the city before the new administration takes office. These disputed claims involve an amount of nearly $14,000,000.

Comptroller Metz has received daily calls from the representatives of the six gas and four electric light companies for some time past urging him to effect a settlement with them before he retires from office. The comptroller has referred the matter to a committee of three, made up of representatives of his and the Corporation Counsel's office. The six gas companies have claims against the city amounting to $4,395,768 and the four electric lighting companies have claims amounting to $2,504,555, making a total of $6,900,323. In addition to this the electric light companies want $593,000 interest, which brings the total up to $7,493,823.

This is offset to a large extent by a claim for franchise taxes which the city has against the ten lighting companies. The companies dispute the correctness of this claim, the city disputes the accuracy of the claim for lighting, and the whole matter is in considerable confusion.

Electric Line from Chicago to St. Louis.

As was mentioned in the last issue, arrangements have been made whereby the Chicago, Joliet & St. Louis Electric Railway Company is enabled to enter the city of Chicago. Further information on the newly-formed company was recently given out by their treasurer, F. E. Fisher, who said: "The new company is to be the parent company of the Joliet, Plainfield & Aurora Railway Company, the Joliet & Southern Traction Company, the Bloomington, Pontiac & Joliet Railway Company, and the Chicago, Joliet & Central Illinois Railway Company. Besides the territory which these roads now cover, it is our intention next spring to run a line from Chicago Heights to Hammond, Ind., and from Joliet to Chicago, to connect with the Metropolitan Elevated. The road from Pontiac to Bloomington is being built at present as fast as the weather will permit. At Bloomington it is our intention to connect with the McKinley traction system, which runs to St. Louis."

Use of Queensboro Bridge.

The New York Public Service Commission adopted an order for a hearing to be held by Commissioner Bassett on January 3 to pass upon the terms of the franchise recently granted by the New York city Board of Estimate and Apportionment for the operation of cars over the Queensboro bridge by the New York & Queens County Railway Company.

Electricity in a Brewery.

A brewery company at Castle Eden, Durham, England, has recently erected an electric generating station for the electric lighting and heating of the brewery and to drive the machinery therein, and also to supply current to the private houses in the vicinity.

QUESTIONS and ANSWERS

ADAPTABILITY OF ELECTRIC VEHICLES FOR COLD WEATHER.—Is the gasoline automobile more reliable in cold weather than the electric? A garage man told me that the electric batteries are liable to freeze. I have seen that many chauffeurs experience trouble in starting their gasoline engines on cold days, but the electrics seem to start very easily. Which has the greater advantage in winter?—V. B., Milwaukee, Wis.

The freezing point of the sulphuric acid used as electrolyte in vehicle storage batteries is considerably below zero Fahrenheit, and it has been found by battery experts that at no place in the United States, except possibly in certain parts of Alaska, do electric vehicle batteries freeze in the coldest weather experienced. The capacity of the battery is slightly diminished at low temperatures, so that the mileage per charge will be somewhat reduced. On the other hand, the efficiency of the motor is slightly increased with reduction of temperature. The electric vehicle is ready to start from rest at any time and never has its motors running idle. Contrasted with this, the gasoline car needs the most careful attention to enable its engines to be started with very cold cylinders. For this reason many chauffeurs keep their engines running idle during even long stops. These facts show the peculiar adaptability of the electric vehicle for winter service and that it has then even more relative advantages over its gasoline rival than in summer.

TUNGSTEN LAMPS FOR AUTOMOBILE SERVICE.—An acquaintance of mine claims to have tungsten lamps on his automobile. They look to be like ordinary small incandescent lamps, except that they are very bright. Is not the tungsten lamp too fragile for such work?—S. F., Cedar Rapids, Ia.

Tungsten lamps are now quite commonly used for automobile service. Low-voltage tungstens have a relatively thick and short filament, which is quite rugged and capable of withstanding the vibrations and shocks of this service. They are generally designed for six volts, so that they may be fed from the ignition storage battery in the case of gasoline cars. As compared with carbon miniature lamps, tungsten lamps consume only about one-third as much energy and therefore are not so heavy a drain on the batteries. They also give a whiter light, showing much less depreciation with age. Over oil lamps they have the advantages of freedom from odor and drip and the important feature of not being blown out by wind. As compared with acetylene lamps, they are safer, do not freeze, are free from glare and are much more perfectly controlled. In high-priced cars tungsten lamps are now commonly used for illumination within the car body.

LACK OF CAPACITY IN A MOTOR-GENERATOR SET.—We have a motor-generator set for getting direct current from the sixty-cycle supply. The motor is a 2,300-volt induction motor rated at fifteen horsepower; the generator is a 250-volt compound dynamo, which is supposed to give ten kilowatts, according to its name plate. The machines run all right till we get above 250 amperes direct current; above that we cannot keep up the dynamo voltage and just below 400 amperes, which should be full load, both machines get very hot, especially the dynamo. What can be the cause of the trouble?—J. B. S., Buffalo, N. Y.

A number of causes, singly or together, may be at the root of this trouble. Assuming the ratings on the name plates to be right, the direct-current ammeter may be reading too low so that the real load is actually much greater than that indicated; this seems to be shown by the statement that both machines run hot at what is supposed to be full load. On the other hand, one or both machines may be overrated and therefore incapable of carrying such a heavy load. Aside from errors in rating, the machines may have defects in design. For example, the dynamo may be undercompounded; the speed of an induction motor decreases a few per cent as the load comes on; unless this was taken into account in designing the compounding, the dynamo will not maintain the required voltage. Aside from these possible causes, the circuit supplying the set may be of insufficient carrying capacity, thus resulting in excessive line drop and deficiency in voltage impressed on the motor, as the load gets heavy. A complete test of both machines and the line conditions is advisable to determine the exact cause or causes.

INDUCTION FURNACES.—What is an induction furnace? Does it use an arc between carbons?—C. L. T., Johnstown, Pa.

An induction furnace does not make use of either carbons or arc. It is built on the principle of a transformer, of which the primary coil is connected to the source of current, and the secondary is a short-circuited ring formed of the material to be treated. The current in the latter is generated by induction, from which this type of furnace derives its name. This furnace is very efficient and free from electrode costs and troubles. It is restricted to certain electrometallurgical processes, however, in which the charge is conducting and the action is almost entirely due to the heating effect of the current, so that an alternating current may be employed advantageously. Induction furnaces are being used extensively now for the electric refining of steel. Recent illustrated articles describing induction furnaces may be found in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of July 3 and October 9, 1909.

SYNCHRONOUS VERSUS INDUCTION MOTORS.—We have been advised to change our fifty-horsepower induction motor to a synchronous motor, as the inspector of the current supply claims that our machine causes a very poor power factor on the line and interferes with other consumers. He also claims the synchronous motor will run steadier. Does this motor not require more attention? We now get sufficiently satisfactory results. Would we be justified in changing motors?—M. R., Chicago.

An induction motor running at very much below its rated load produces a low power factor and therefore burdens the line with wattless current. A synchronous motor can be made to neutralize the disturbance due to such inductive load by overexcitation of its field circuit. Therefore, central-stations are glad to have some synchronous motors on their lines. These motors usually require an attendant to give the best results, unless running on practically con-

stant load. They give an absolutely constant speed, however, from no-load to the heavy over-load at which they suddenly go out of synchronism. A change to this type of motor would be justified, if it was done at the expense of the central station, which would be the chief gainer thereby.

BREAKING THE FIELD OF A SYNCHRONOUS MOTOR.—What happens when the field current of a synchronous motor is suddenly broken?—J. K. P., Salt Lake City, Utah.

On breaking the field of a synchronous motor it will continue to run as an induction motor at slightly below synchronous speed, unless the load it is driving is very heavy. In the latter case the motor will be stalled and stop, because its torque or turning power as an induction motor is very much less than it is as a synchronous motor. At the instant of change the current would change from leading or nearly in phase with the electromotive force to decidedly lagging behind the latter.

Meeting of the Technical Publicity Association.

The December meeting of the Technical Publicity Association, which was held in New York city on the evening of Thursday, December 9, brought out a lively discussion on the subject of circulation and the introduction of a proposed uniform advertising contract for trade papers. Frank H. Gale, in charge of advertising for the General Electric Company, Schenectady, N. Y., presided during the debate. The discussion was participated in by several leading publishers, the consensus of opinion being that the day of false circulation was past, and the sincere publisher was in agreement with the advertising man that both quantity and quality of circulation should receive the most careful consideration, and the value of a medium based first upon the quality of the editorials contributed and then the quantity of the circulation based upon a quality standpoint. H. B. Swetland, publisher of Automobile, and a number of other leading trade papers, said it was his purpose as a publisher to furnish maximum quantity, but that for a trade paper to go beyond a certain quantity was certain to vitiate itself.

The matter of a uniform contract will be discussed again at the next regular meeting of the association in January.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

LONG ISLAND ELECTRIC RAILWAY.

The New York Public Service Commission has issued a report covering the operations of the Long Island Electric Railway Company for the year ended June 30, 1909, as follows:

Total operating revenue	$185,369
Operating expenses	144,076
Net operating revenue	$41,293
Taxes accrued	*12,142
Operating income	$29,151
Other income	3,036
Gross income	$32,187
Interest on funded debt	30,000
Net corporate income	$2,187
Susplus, June 30, 1908	215,865
Items of prior period	14,156
Surplus, June 30, 1909	$232,208

CUMBERLAND TELEPHONE AND TELEGRAPH

The report of the Cumberland Telephone and Telegraph Company for the month of November and eleven months ended November 30, 1909, compares as follows:

	1909	1908
November gross	$560,032	$535,062
Expenses	306,971	286,931
November net	$253,061	$248,131
Charges	40,742	44,638
November surplus	$212,319	$203,492
Eleven months gross	5,852,985	5,606,155
Expenses	3,327,092	3,212,414
Eleven months net	$2,525,893	$2,339,741
Charges	464,964	430,896
Eleven months surplus	$2,060,929	$1,962,845

NORTHERN OHIO TRACTION AND LIGHT.

The report of the Northern Ohio Traction and Light Company for the month of November and eleven months ended November 30, compares as follows:

	1909	1908
November gross	$175,742	$151,934
Expenses	99,972	87,976
November net	$75,770	$63,958
Fixed charges	43,399	44,011
November surplus	$32,370	$19,946
Eleven months gross	1,994,729	1,730,019
Expenses	1,088,502	1,000,276
Eleven months net	$906,227	$729,743
Fixed charges	480,856	482,533
Eleven months surplus	$425,371	$247,210

MONTREAL STREET RAILWAY.

The report of the Montreal Street Railway Company for the month of November and two months ended November 30, 1909, compares as follows:

	1909	1908
November gross	$334,871	$301,578
Expenses	200,138	180,682
November net	$134,733	$120,896
Charges, taxes, etc	30,785	29,662
November surplus	$103,940	$91,234
Two months gross	688,878	630,186
Expenses	374,872	346,106
Two months net	$314,006	$284,080
Charges, taxes, etc	61,864	59,842
Two months surplus	$252,142	$224,238

AMERICAN LIGHT AND TRACTION.

The report of the American Light and Traction Company for the month of November and eleven months ended November 30, compares as follows:

	1909	1908
November gross	$333,649	$282,695
Expenses	8,644	2,000
November net	$325,004	$280,695
Eleven months gross	2,953,618	2,412,721
Expenses	96,699	42,000
Eleven months net	$2,856,919	$2,370,721

AMERICAN TELEPHONE AND TELEGRAPH.

The report of the American Telephone and Telegraph Company, for the month of November and eleven months ended November 30, 1909, compares as follows:

	1909	1908
Dividends	$742,722	$729,570
Interest and other revenue	890,465	794,931
Telephone traffic (net)	369,791	464,168
Real estate	7,965	13,994
Other sources	138,854	58,181
Total	$2,149,800	$2,060,844
Expenses	246,907	169,388
Net	$1,902,893	$1,891,456
Interest	524,182	638,868
Balance	$1,378,711	$1,252,588
Eleven months:		
Dividends	$14,813,400	$13,280,127
Interest and other revenue	9,772,363	8,882,006
Telephone traffic (net)	3,979,384	3,637,662
Real estate	88,420	149,510
Other sources	1,276,112	706,090
Total	$29,929,679	$26,655,396
Expenses	2,342,098	1,905,449
Net	$27,587,581	$24,749,947
Interest	6,558,697	7,019,614
Balance	$21,028,883	$17,730,333
Dividends	11,963,759	9,289,624
Surplus	$9,065,125	$8,440,709

In 1909 all maintenance and depreciation is charged against expenses monthly instead of being partly provided for by an extraordinary charge in December, as heretofore. In order that a true comparison may be made between 1908 and 1909, the 1908 figures as now presented include in expenses for each month one-twelfth of the extraordinary provision for depreciation which was made in December, 1908.

UNITED RAILWAYS OF ST. LOUIS.

The report of the United Railways of St. Louis, for the month of November, 1909, compares as follows:

	1909	1908
November gross	$927,450	$872,339
Expense	581,014	536,636
November net	$346,436	$335,703
Charges	232,107	233,694
November surplus	$114,329	$102,009

BOSTON SUBURBAN ELECTRIC.

The gross earnings of the Middlesex & Boston and Lexington & Boston Street Railway companies, subsidiaries of the Boston Suburban Electric Company, for the month of November were $60,815, a decrease of $4,152, and net $16,187, an increase of $1,383. The surplus, after charges, was $2,573, an increase of $1,074. The gross earnings for

two months ended November 30 amounted to $128,978, a decrease of $6,088. The surplus, after charges, was $8,674, a decrease of $2,273.

CENTRAL AND SOUTHERN AMERICAN TELEGRAPH.

The report of the Central and South American Telegraph Company for the quarter ended December 31, 1909 (partly estimated) compares as follows:

	1909	1908
Gross	$445,500	$415,000
Expenses	167,000	165,000
Net	$278,500	$250,000
Other income	5,200	4,500
Total income	$283,700	$254,500
Dividends	143,565	143,565
Surplus	$150,135	$110,935
Previous surplus	1,634,958	1,342,550
Total surplus	$1,775,093	$1,453,485

MEXICAN TELEGRAPH.

The report of the Mexican Telegraph Company for the quarter ended December 31 (partly estimated) compares as follows:

	1909	1908
Gross	$195,000	$172,000
Expenses	37,500	41,000
Net	$157,500	$131,000
Other income	25,000	25,500
Total income	$182,500	$156,500
Mexican Govt. property	8,000	7,500
Balance	$174,500	$149,000
Dividends	89,735	71,752
Surplus	$84,765	$77,248
Previous surplus	2,192,127	2,624,522
Total surplus	$2,276,892	$2,701,770

DETROIT UNITED.

The report of the Detroit United Railroad Company for the month of November and eleven months ended November 30, 1909, compares as follows:

	1909	1908
November gross	$676,482	$570,711
Expenses	440,750	*374,685
November net	$235,732	$196,026
Other income	10,611	6,497
Total income	$246,343	$202,523
Charges, taxes, etc.	157,919	*132,819
November surplus	$88,424	$69,704
Eleven months gross	7,351,390	6,508,894
Expenses	4,614,783	*4,182,788
Eleven months net	$2,736,607	$2,326,106
Other income	132,134	57,918
Total income	$2,868,741	$2,384,024
Charges, taxes, etc.	1,723,399	*1,485,058
Eleven months surplus	$1,145,342	$898,966

* Taxes in 1908 and 1907 are included in operating expenses.

SHAWINIGAN WATER AND POWER.

The Shawinigan Water and Power Company's earnings for the first ten months of the year were $603,675, against $563,679 in the same period last year, an increase of $39,996.

The company's recent purchase of 7,000 shares of Montreal Power was financed by the sale of $1,000,000 of new debenture stock. It gets about five and three-quarters per cent on its investment of Power stock, and pays four and one-half per cent on its own debenture issue.

CHICAGO RAILWAYS.

The report of the Chicago Railways Company, for the month of October and nine months ended October 31, 1909, compares as follows:

	1909	1908
Gross earnings	$1,083,355	$945,341
Miscellaneous	26,285	23,202
Total gross	$1,109,640	$968,543
Expenses, 70 per cent	776,748	677,979
Net, 30 per cent	$ 332,892	$290,563
Interest on property, 5 per cent	203,626	149,730
Net income	$ 129,265	$140,832
City's share, 55 per cent	71,096	77,458
Company's share, 45 per cent.	$ 58,169	$ 63,374

For nine months: Gross earnings, $9,272,109; thirty per cent of gross, $2,789,517; five per cent interest on valuation of property, $1,641,108; net income, $1,148,408; city's share, fifty-five per cent, $631,624; company's share, forty-five per cent, $516,783.

TOLEDO RAILWAYS AND LIGHT.

The report of the Toledo Railways and Light Company for the month of November and eleven months ended November 30, 1909, compares as follows:

	1909.	1908.
November gross	$ 246,185	$ 219,761
Expenses	126,046	117,372
November net	$ 120,139	$ 102,389
Other income	183	124
Total income	$ 120,322	$ 102,513
Charges and taxes	75,757	71,960
November surplus	$ 44,565	$ 30,553
Eleven months gross	2,466,996	2,302,658
Expenses	1,389,815	1,237,178
Eleven months net	$1,077,181	$1,045,480
Other income	2,628	3,384
Total income	$1,079,809	$1,048,864
Charges and taxes	803,576	779,657
Eleven months surplus	$ 276,233	$ 269,207

NIAGARA, LOCKPORT AND ONTARIO.

The report of the Niagara, Lockport and Ontario Power Company for the month of November and five months ended November 30, 1909, compares as follows:

	November, 1909	July 1-November 30
Gross earnings	$41,929	$208,168
Expenses	16,498	80,574
Net earnings	$25,431	$127,593
Other income	1,696	8,072
Total income	$27,127	$135,666
Interest	20,833	104,167
Surplus	$6,294	$31,499

WESTINGHOUSE ELECTRIC.

Some surprise has been expressed that directors of the Westinghouse Electric, at the time the regular dividend on the preferred was declared recently, took no action toward paying up any further portion of the nine per cent of accrued dividends on the approximately $4,000,000 preferred stock. Last September the directors declared a dividend of three and one-half per cent toward the reduction of the then twelve and one-half per cent of accrued dividends, and the understanding was that a further declaration would be made with the January payment.

The cause of the delay has been that directors deemed it expedient to make various charge-offs for inventory account, the aggregate of which was considerable. It is probable, however, that the balance of accumulated dividends on the preferred will be paid off before the end of 1910.

KEYSTONE TELEPHONE COMPANY.

The report of the Keystone Telephone Company, of Philadelphia, for the month of November and five months ended November 30, 1909, compares as follows:

	1909	1908
November gross	$91,851	$88,377
Expenses and taxes	45,611	42,701
November net	$46,240	$45,676
Charges	24,634	34,389
November surplus	$21,606	$11,287
Five months gross	456,262	439,383
Expenses and taxes	226,678	217,455
Five months net	$229,584	$221,928
Charges	159,230	172,556
Five months surplus	$70,354	$49,372

METROPOLITAN WEST SIDE ELEVATED.

The Metropolitan West Side Elevated Railway Company, of Chicago, has placed its preferred stock on a three per cent yearly basis. The first quarterly payment of three-fourths of one per cent will be made March 1.

Outside of the $10,000,000 first mortgage and $5,000,000 extension mortgage bonds, due 1938, the only outstanding indebtedness of the company is $300,000 five per cent collateral trust notes which mature and are being retired at the rate of $50,000 each six months.

President Hetzler says: "The depressed condition in the manufacturing district during the last two years seriously affected earnings, but conditions are again normal and traffic is gaining rapidly. The company is in excellent shape financially. There are no extensive capital expenditures in prospect and no re-financing is required."

An article of interest to electric-railway men appears in the December 23 issue of *Engineering News*, in which A. D. Williams, Jr., of East Liberty, Pittsburg, gives in great detail the cost data of a short interurban line in the northwestern part of Ohio.

AMONG THE CONTRACTORS AND SUPPLY MEN

To know what is going on among the men who do things and those who supply the material for the doing is always interesting. The actual happenings of the day with the contractors and the men who furnish them with supplies of all kinds, accurately reported from all parts of the country, is the object of this department.

THE NORTHERN ELECTRIC COMPANY, of Burlington, Vt., of which E. H. Vancor is president, has secured the contract to build the high voltage transmission line from Cady's Falls to Stowe, whereby power will be furnishing by the Morrisville Power plant for operating the Stowe-Waterbury electric railroad. M. G. Clark, general manager of the Northern Electric Company, is already on the ground and will have personal supervision of the construction of the line. The contract requires that the installation will be completed within six days.

THE KATZ-CRAIG CONSTRUCTION COMPANY, of Omaha, Neb., has been granted the contract for the construction of a municipal lighting and power plant at Valentine, Neb. The engineering work is done by the W. K. Palmer Company, engineers, of Kansas City, Mo. C.

THE ROSEBERRY-HENRY ELECTRIC COMANY, Grand Rapids, Mich., has succeeded to the business of the M. B. Wheeler Electric Company, making a specialty of power installations and the distribution of supplies and apparatus. The company has a contract for the electrification of the Stewart-Hartshorn Company's roller factory at Muskegon, Mich., and is installing sixty-one motors, aggregating a total of 450 horsepower. The company is also wiring the new Presbyterian Church at Ionia, Mich., and is installing sixteen motors, aggregating 1,100 horsepower, for the Westinghouse Electric and Manufacturing Company in the sewage pumping stations of the City of Grand Rapids.

THE MINNEAPOLIS MANUFACTURING COMPANY, Minneapolis, Minn., has been awarded the contract for the installation of an electric light and power plant at Wellington, Kansas. The engine to be installed is the "Twin City," and the electrical apparatus is to be furnished to the contractor by the Wesco Electric Company of St. Louis. The contract price inclusive of installation is $7,429.

EDWARD FAY & SON, Philadelphia, Pa., have a contract to build a $13,000 power house on the grounds of the Naval Asylum on Gray's Ferry Road.

BARRY, HARRIS & CO., electrical contractors, at 35 West Sixth Avenue, Gary, Ind., have recently dissolved partnership. The firm originally started business in Gary about one year ago as the Barry-Faust Electrical Company, Last January Mr. Faust retired from the company, A. B. Harris taking his place. Hereafter the business will be conducted at the same location by Mr. Harris, J. R. Barry withdrawing from the firm. Mr. Barry has not yet announced his future plans.

F. O. PLUMMER has been awarded the contract for the electric work in the new Nashawena Mills in New Bedford. This is the largest electrically driven cotton mill in the United States, using 5,000 horsepower in motors ranging in size from twenty to 200 horsepower, and requiring about 15,000 lights for the entire mill.

THE LANGSTADT & MEYER ELECTRICAL CONSTRUCTION COMPANY, of Appleton, Wis., has completed the construction of a big electrical plant for the C. A. Goodyear Lumber Company, of Tomah, Wis. The mill has an electrical capacity of 1,200 horsepower and a sawing capacity of no less than 100,000 feet of lumber per day.

THE ESTERLINE COMPANY, Lafayette, Ind., has secured the contract to build an electric light and power plant in the new building for the deaf and dumb at Indianapolis; also for the installation of a full set of motor drives for all of the machinery now being installed in the American Box-Ball Company's new plant recently erected in Indianapolis.

THE SALT LAKE ELECTRIC SUPPLY COMPANY, Salt Lake City, Utah, has been awarded two of the contracts for the installation of the new lighting system in the government post at Fort Douglas, Utah. One of these contracts was for the construction of the power transmission line and feed wires, and amounted to $11,794; the other, for the construction of a transmission substation, was $2,009.50. The work is to be completed by February 19, 1910.

THE METEOR ELECTRIC COMPANY, Salt Lake City, Utah, has been awarded the contract for the wiring of buildings and installation of fixtures, at the post at Fort Douglas, Utah, for $9,418.50. The installation is to be completed by February 10, 1910.

THE P. K. ENGINEERING COMPANY, of St. Louis, Mo., has been awarded the contract for installing a boiler in the municipal electric light plant at Fort Wayne, Ind. The boiler is to be a Lyons safety boiler, 425 horsepower and will cost $6,250. S.

THE FELTON COMPANY, and the GLOBE ELECTRIC COMPANY, both of San Francisco, have been awarded the contract for installing an electric lighting, wiring and conduit system in the building at the corner of Brannan and Second streets. The bid of these companies was $3,250.

THE VIRGINIAN ELECTRIC AND MACHINE WORKS, of Charleston, W. Va., announces that it has purchased the plant, business and patents of the Agnew Electric Company, also of Charleston. The manufacture of the well known types of the Agnew direct-current motors, automatic rheostats, bronze rotary pumps and other electrical apparatus will be continued, and all agreements and contracts made by Edwin M. Keatley, receiver of the Agnew Electric Company, will be carried out by its successor.

Manufacture Costs of Air Nitrates.

A recent estimate places the cost of the production of calcareous nitrogen containing twenty per cent nitrogen, at 270 to 315 francs ($52.11 to $60.79) per metric ton (2,204.6 pounds). This would make the nitrogen in the compound cost twenty-six to thirty cents a kilogramme (2.2 pounds), while the cost of the nitrogen in compounds formed by the direct combination of the elements in the air is generally conceded to be less. The experiments made with fertilizers of either system, in comparison with Chilean saltpeter, are generally favorable to the artificial product. In sandy soil the calcium nitrate formed by the direct combination of the elements in the air brought even better results than the Chilean saltpeter.

Calcareous nitrogen, which has the chemical formula $Ca\ (CN)\ N$, is formed by passing nitrogen over heated calcium carbide or through a heated mixture of lime and charcoal. It would seem, therefore, that air nitrates made by one of the direct, or electrical, processes, will eventually displace these other products.

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

Westinghouse Type C Three-Phase Transformers.

The three-phase transformer presents certain inherent advantages of compactness in construction and installation, since it supplants with a single piece of apparatus the equivalent group of three single-phase transformers otherwise required for the same service. The simplicity of connections and the better appearance presented by the three-phase transformer when installed on a pole or elsewhere, has led many customers to prefer it to the equivalent arrangement of three single-phase transformers.

Recent marked improvements have been made in Westinghouse type C three-phase transformers, resulting, besides in decided advances in both construction and performance as well as the advantages already enumerated as inherent to this design. In these transformers the losses are reduced below those of any ordinary equivalent combination for transforming three-phase power, while experience in design and modern factory methods have produced a highly serviceable apparatus that can be sold below the price of the equivalent single-phase transformer group.

WESTINGHOUSE THREE-PHASE TRANSFORMER.

These type C three-phase transformers are made in sizes ranging from five to seventy-five kilowatts capacity, and display very high efficiency at all loads, as well as close regulation when operating on currents having low power-factors. These properties of good regulation and efficiency, together with the compactness and simplicity of type C three-phase transformers, make them especially adaptable for supplying motor loads.

The accompanying illustrations show the appearance and construction of this piece of apparatus. The cast-iron corrugated case employed is quite similar in design to that used in the well-known Westinghouse type S transformer. The three high-tension leads enter from the front side of the transformer, the low-tension secondaries issuing from the pole side of the case. Provision has also been made for bringing out neutral leads, when desired, from both the high and low-tension windings. Separate terminal blocks are provided for both the high and low-tension leads of each of the three phases. Each low-tension winding comprises two coils which can be connected in parallel for 110 volts, or in series for 220 volts, the standard designs being for 2,200 volts on the high-tension side. In general, the design and construction are developments of the well-known Westinghouse type S, single-phase, lighting transformer, and the transformers have the advantage of the same material and workmanship.

THREE-PHASE TRANSFORMER WITH COVER REMOVED.

A New Product of the Massachusetts Chemical Company.

In connection with the development of its already extensive line of insulating materials the Massachusetts Chemical Company, Walpole, Mass., has had exceptional opportunity to study the effect of a wide variety of materials and processes upon the strength, durability, adhesiveness, insulation and other qualities of insulating tape. This opportunity it has not neglected, for constant study and experiment have been maintained with the idea ever in view of producing a thoroughly satisfactory tape for each particular purpose.

Walpole tape is always packed in 80-foot lengths, three-quarter inches wide, in round tin boxes. It is made upon a strong fabric, manufactured expressly for this purpose, thoroughly impregnated with a special compound having remarkable qualities of insulation, adhesiveness and resistance to atmospheric action. Under many tons pressure this compound is rolled into the fabric, filling every pore, crowding between the fibres, closing the most minute pin holes, and providing an absolutely impervious coating upon each side of the fabric. The friction is noticeably smooth. The result is perfect protection from the elements and, as a consequence, enduring strength. The composition of the compound keeps it constantly "tacky," without variation under extremes of temperature, and amply adhesive for all requirements, but not so much as as to interfere with easy handling. The compound contains nothing that will corrode copper or in any way affect materials with which it may come in contact.

The tin box in which Walpole tape is always packed makes it distinctive. Although the guarantee upon this box specifically covers only one year, it in no sense measures the length of life of this tape, for the manufacturers claim that it will retain its qualities for a longer period, no matter what the climate or the altitude. Packed as it is this tape is evidently most convenient to ship and handle, being particularly satisfactory from the standpoint of the workman. The box preserves any unused portion of the roll and is in itself an inducement to care and economy in the use of the tape.

Its all-around qualities evidently destine Walpole tape to occupy a most important position in the electrical field, where unusual strength and adhesiveness, insulating qualities, and durability measure its true value.

Train Dispatching by Telephone.

The Chicago & Northwestern Railroad Company has recently purchased from the Western Electric Company apparatus for a complete telephone train dispatching circuit extending from Chadron, Nebraska, to Long Pine, Nebraska, a distance of 198 miles. The circuit will be very complete and the line itself has been constructed entirely of new material.

The telephone method of handling trains is of special value in sections such as that between Chadron and Long Pine, owing to the fact that during certain seasons of the year a great many of the stations consist simply of sidings. These stations, however, during a large portion of the year are important shipping points for the ranchers in that vicinity. In many places there are no telegraph stations and at such points telephones will be installed, rendering it possible for any authorized person to obtain stock cars or other freight accommodations much more rapidly than would be possible if it were necessary to handle the business through the nearest telegraph office.

At a great many of these sidings local freight trains and other trains are held waiting for passenger trains, and in case of delays this arrangement has been a source of considerable expense, due to the fact that it has been impossible to get word to the trains and arrange for their forward movement. These delays will be minimized by the use of the telephone system of train dispatching.

The Louisville & Nashville Railway Company will also do its train dispatching by telephone and is installing a complete up-to-date telephone circuit for the purpose between New Orleans and Mobile. This telephone circuit will be the first to be installed in that section of the country for the purpose of handling trains and will be watched with considerable interest by the other roads in that vicinity. It is, however, the second circuit installed by this railroad, the former one being between Louisville and Cincinnati. The officials of the road report that the service on the first circuit between Louisville and Cincinnati is giving entirely satisfactory service in all particulars. The apparatus employed by this road is also manufactured by the Western Electric Company.

The Norfolk & Western Railroad has recently placed orders for four complete telephone train-dispatching circuits from Norfolk, Va., to Crewe, twenty-seven stations, 130 miles; Crewe to Roanoke, thirty-three stations, 126 miles; Williamson, W. Va., to Portsmouth, Ohio, twenty-two stations, 113 miles; and Portsmouth, Ohio, to Columbus, Ohio, twenty-two stations, 100 miles. These circuits, in addition to the two circuits now in operation between Roanoke and Bluefield and between Bluefield and Williamson, W. Va., will complete the telephone train-dispatching equipment for the entire main line between Norfolk and Columbus, about 700 miles, with about 125 stations equipped. The telephone apparatus for all these circuits is of Western Electric manufacture. W. C. Walstrum, superintendent of telegraph, reports that the two circuits now in operation are giving excellent service.

System for Securing 100 Per Cent Load Factor.

A new development in the electric heating problem is presented in the Therol system, now on exhibition at the offices of the Therol Company, 30 Church Street, New York. The system has been in successful operation in England for several months, and is, in the opinion of the British technical press, likely to do much towards increasing the current supply to residences and hotels.

The Therol system, by a method of heat storage, aims to provide control stations with 100 per cent load-factor consumers. Several are in use by British central stations and they are now supplying current to Therol consumers at about one-fourth or one-fifth the price of current for lighting alone.

The apparatus consists, in its simplest form, of an iron block in which is placed a removable heat unit. A coil is cast in the iron block, the block being heated to a temperature of 500 to 800 degrees Fahrenheit. It is surrounded by magnesia insulation, outside of which is a water jacket to absorb any heat which may escape through the first layer of insulation. Outside the water jacket is another layer of magnesia, giving an efficiency of over ninety per cent in the storage of heat.

When lights are turned on, current is automatically switched off the heater in sufficient quantity to supply the lights, thus creating no increase in the constant demand on the station. Current can also be drawn from the heater's constant supply for ironing, Therol cooking, or any other domestic use.

No water is stored under the Therol system. Heat only is stored, and used as occasion may demand for the instantaneous heating of water. As the temperature of the iron block is several hundred degrees, as soon as water is introduced into the coil imbedded in the block it is turned into superheated steam. This steam is introduced into water at normal temperature, raising it to boiling, or any lesser degree of heat, according to the quantity of superheated steam introduced.

An ordinary heater, consuming a constant supply of 300 watts, will provide thirty gallons of water for domestic use at the highest temperature at which it can be used, 110 to 120 degrees, besides providing for three to four hours' burnings of lights up to the maximum demand of 300 watts.

A cooker is supplied, operated in connection with the heater, which consumes, for ordinary purposes, 100 watts during a part of the day. This supply of current is drawn from the heater, and when not used in the cooker goes toward storing heat for the water supply.

Addition to Kellogg Factory.

About a third of the Kellogg sales force recently spent a day inspecting the lately finished addition to the cabinet-making factory. This new structure is a handsome brick building, 60 by 200 feet, well lighted and completely equipped.

Besides the large new glue machine and apparatus for handling the rough lumber there are twenty-two separate machines for the producing of telephone cabinet parts, among which are lathes, belted sanders, planing machines, and glue machines. The majority of the machine equipment is individual drive.

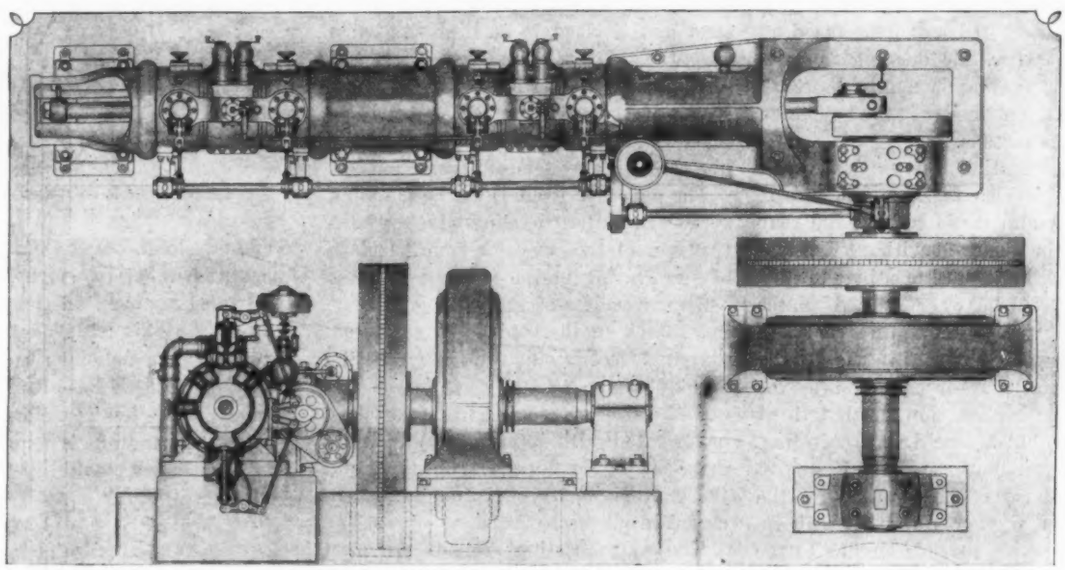
The great quantity of rough lumber, partly finished stock and assembled boxes that are in the factory at this time is evidence of the amount of work going through the factory daily.

Among those present on the inspection tour were: L. D. Kellogg, J. B. Edwards, J. C. Kelsey, C. S. Winston, W. R. Hind, A. S. Hallstrom, A. D. Carter, G. A. Joy, G. H. Crandall, H. N. Faris, L. R. Foote, F. C. King, E. G. Lawrence, O. Morsman, J. C. Murray, R. W. Pillars, A. E. Weber and W. R. Boze.

A New Double-Acting Gas Engine.

The Minneapolis Steel and Machinery Company, Minneapolis, Minn., has recently completed the construction of a new double-acting gas engine, a view of which is shown in the accompanying illustration. In constructing this engine it has been the aim of the manufacturers to have it possess the following characteristics: Reliability, economy, moderate price, accessibility, durability as affecting cost of upkeep, good systems of oiling and cooling and be easy of attendance.

In general this engine is a side crank machine with counterbalanced crank, marine end connecting rod, steel crossheads, bored guides, tail rod, water-cooled pistons, piston rods and exhaust valves. Special attention has been given to making all parts easy of access.



END VIEW AND PLAN OF DOUBLE-ACTING GAS ENGINE.

Reference to the illustration will show the engine supported on foundations under the tail slide, spreader or tie piece and the main bed, leaving the large open spaces under the cylinders for ready access to and handling of the exhaust valves and their cages and operating levers.

The main frame contains the main bearing and the bored guides for the main crosshead and somewhat resembles a heavy steel engine bed except that an opening in the end next to the cylinder is large enough for the cylinder head to come through it, permitting easy removal of same. The bed has upper and lower guides bored concentric with the center of the cylinders exactly as a steam engine.

The main bearing has a ball or spherical seat, and is also fitted with quarter boxes adjustable by wedges. These quarter boxes are carried high above the center of the shaft permitting the cap casting to be left entirely without babbitt. The lower shell can be water cooled if necessary and can be removed by lifting the shaft one-eighth of an inch.

The crosshead is of cast steel fitted with adjustable babbitt-faced shoes, movable on inclined surfaces. Each shoe is adjusted by means of two studs and nuts and then held solidly in place by four large cap screws which relieve the adjusting studs and nuts of the working stresses. The crosshead pin is ground to fit tapered holes in the crosshead and held firmly in place by a dowel and nut.

The connecting rod is a thoroughly annealed open-hearth steel forging, its length from center to center of the boxes is two and one-half times the stroke of the engine. Both ends have steel boxes lined with babbitt and bored, with wedge adjustment arranged to keep the distance from center to center of boxes constantly under adjustment.

The crank is a steel casting with a pin and counter-balance cast on. The oiling of the pin is done by a regular centrifugal oiler. The piston rods are of nickel steel and are hollow for the circulation of water to carry away the heat from themselves and the pistons. The rods are cambered in turning so that when the weight of the piston comes upon the rod it will be straight and will support the piston, relieving the cylinder wall of wear from the weight of piston, while leaving the rings free to expand and perform their work.

The pistons are single castings made hollow and furnished with proper openings for receiving and discharging the cooling water. The latter opening being so placed that the piston must always be full of water before the discharge can take place. A loose disk is provided one-half inch thick, its inner chamber being large enough to allow the withdrawal of the pipe plug that closes the hole in the center of the piston rod. This disk is held in position by dowel pins. The crosshead and piston rod are fastened together by a forged steel nut having inside and outside threads of different pitch. This forces the end of the rod against the disk which receives the thrust and tightens the thread on the rod.

The cylinders are cast in one piece except, to avoid shrinkage strains there is an open space in the water jacket the full circumference of the cylinder. This opening is closed by a cast belt properly machined and made watertight.

The openings for the valve cages and valves, spark plugs and air starting valves are cast in the cylinders and properly fitted. The inlet valves are in the top of the cylinders and the exhaust valves in the bottom, this arrangement permitting the ready carrying out of any carbonized oil or other residue by the outward flow of the exhaust gases.

The inlet valves are placed in a cage

in the opening on top of the cylinder. The inlet valve proper is of cast iron with a steel stem screwed and riveted in. Immediately above this valve and on the same stem is a secondary gas valve mounted loosely on the stem and held to its seat by a spring until forced away by a shoulder on the stem.

The exhaust valve heads are of cast iron made hollow with hollow steel stems screwed into them and securely pinned. A special casting forms a nut, spring seat and water circulating inlet and discharge. A suitable chamber permits the water to enter the hollow stem and a half-inch pipe is screwed into the center and extends to within a quarter of an inch of the upper wall of the valve head casting.

The spreader is cast in one piece with a lower guide bored and ends faced at the same setting, the opening in each side of this casting is amply large to permit the removal of the cylinder heads or the pistons.

The rear casting carrying the tail block slide is also faced and bored at one setting and made so that the rear head may be removed without disturbing this casting. Both castings are securely set in heavy cast bed plates securely bolted to the foundation and provided with slides in which the spreader and rear of casting are free to slide in the direction the length of the engine, but are held rigidly in line.

The intermediate crosshead is a steel casting and forms the coupling for the piston rods by means of nuts with inside and outside threads similar to the main crosshead. The rear crosshead is of cast iron. Both of these have lower guides only, and each is fitted with a shoe adjustable in a similar manner to the main crosshead shoes.

The air starting mechanism is simple yet effective. The air valve and cages are similar to the ones used on the small engines, a mushroom valve held to its seat when in operation by a spring and locked by a hand wheel nut after the engine is in operation. The mechanism which admits the air to this cage at the proper time and then drops out of gear when the air pressure is removed consists of an iron body, and inlet and two outlets. It also consists of a bored valve chamber in which is fitted a piston valve having two sets of ports, one set above the other. The walls of the chamber in the valve slides also have two sets of ports and a horizontal wheel in the space surrounding the valve chamber wall divides the outlet chamber into two separate parts, from each of which one discharge is taken. The air is taken in at the bottom and at once raises the piston, bringing the roller in the upper end of the piston extension in contact with the cam on the cam shaft.

Each cylinder is surmounted by a casting containing the governing valves and the inlet valve cages with their valves also pass through this casting and are securely fastened to it. The air and gas enter this casting through openings on the side away from the valve gear, a butterfly valve being used in each pipe just before entering this casting to shut off entirely by hand when necessary.

The fluids on entering this casting come at once to the governor valves. There are two castings mounted on one stem and finished to such shapes as to vary the relative quantities of gas and air admitted as the load varies. These valves are counterbalanced as nearly as possible and are operated by a governor through a system of levers.

The governor itself is of the Hartung type. In order to eliminate any disturbance of the governor from backlash of the gearing at the moment that the cams and rollers of the valve gear come in contact another spiral gear is used, driven direct from the gear on the crank shaft.

All shafts are carried in chain oiling boxes fitted with interchangeable white metal shells, the gears driving them and the one driving the governor being enclosed in oil-tight cases.

The water cooling systems are most complete, the water being taken out at the highest possible point, giving assurance that the jackets are at all times full. The water is forced in immediately behind the crosshead through both pistons and is discharged through the tail block into a slot in the bed plate. Open discharges are maintained throughout so that an attendant can see that the water is properly discharged.

The crank and crosshead pins, main bearings and all the slides are lubricated by a gravity system with pump and overhead tank. All small pins are provided with dust-proof oil hole fittings.

The ignition system is entirely electrical, a small dynamo being driven from the shaft when no outside source is available. When direct connected to this dynamo advantage may be taken of the current generated thereby, using batteries to start the engine.

Combination Electric Heater, Cooker and Toaster.

Those who are interested in the development of electric heating devices will find an attractive article in the new combination heater, cooker and toaster now being marketed by the Central Electric Company, Chicago, Ill. This useful and novel combination appeals at once to the prospective user of heating devices because of the variety of its functions and its ability to perform more than one of them at a time.

As will be seen from the illustration, the heater is provided with a rectangular metal frame which not only serves

COMBINATION ELECTRIC HEATER, COOKER AND TOASTER.

to embody the heating element but also forms a chamber in which is located a little toasting oven in the shape of a drawer. In this little oven the bread is toasted to a delicious brown by the evenly distributed heat radiated downward from the heating element.

The construction is such that any of the ordinary cooking utensils may

VIEW SHOWING TOASTER OVEN.

be used upon it, no special investment of this sort being necessary. In appearance it is neat, attractive looking, compact and altogether serviceable.

It is built to combine mechanical strength with electrical durability along lines that experience has shown to be most economical and satisfactory for articles to be used by persons inexperienced in the handling of electrical devices.

The heating units, composed of special non-oxidizing alloy, are spiral in shape and of such construction that they can be readily renewed without the use of tools other than a pair of

pliers. A mica strip running lengthwise of each heating unit serves as a support for every convolution of wire, thus preventing any possibility of short circuits. A three-contact switch is provided which enables low, medium and high heats to be secured, thus insuring a minimum consumption of energy.

The Central Electric combination heater appeals at once to those who would prefer to prepare light meals by electricity, but who find that a sufficient selection of heaters, toasters and special utensils is discouragingly expensive. It is also a boon to those, living in hotels or appartments, where space is at a premium and gas not easily accessible, who enjoy having a dainty midnight luncheon after an evening at the card table when it is possible to do so without destroying the effect of the evening's entertainment.

Kuhlman Three-Phase Transformers.

The Kuhlman Electric Company, Elkhart, Ind., began manufacturing transformers in 1903 and the success with which they are meeting is best evidenced by the increasing amount of orders received.

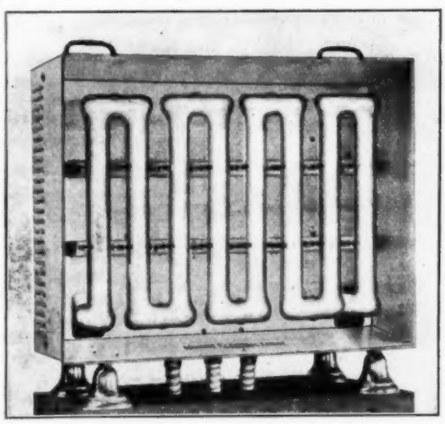
The construction of these transformers is based on the most approved style, consisting of separate magnetic circuits of equal reluctance, each coil operationg upon two circuits, under the same plan as used in generator and motor construction for three-phase circuits. The primaries are connected, so that two windings or legs are always in series and the strain is reduced to a minimum, allowing the use of wire of larger cross-section and making the mechanical construction better. The use of three coils increases the radiating surface and reduces the temperature rise.

Among the advantages claimed by the manufacturers of this transformer are: Secondary distribution for power service, which equally loads the primary phases and maintains balanced voltage, gain in efficiency and regulation, compactness of construction and improved appearance, and reduced weight and less cost as compared to its equivalent capacity in small transformers, the advantages resulting in increase in efficiency, simplicity of connections and better regulation, as well as decrease in the investment.

The White Moore Light for Color Matching.

The inability of electrical manufacturers to supply a suitably colored electric light had until a short time ago seriously handicapped the textile industry in the line of dyeing as well as examining the finished work. It was necessary to judge colors by daylight entirely, but even the light of day varied and in winter the short period in which the light was sufficient severely handicapped the work and resulted in great losses.

The white Moore light has made rapid headway in the textile industry, as it is an unvarying standard of color value, and not only enables the dyer to match his colors better, but also allows the running of the dye shop on a regular schedule. Heretofore dye shops would send a greater part of their employees home on dark afternoons, seriously interfering with the production and work of the dye-house. With the white Moore light this handicap is removed and dye shops can now run on regular time, in fact, many of them are running nights. Woolen and worsted mills also find this light invaluable, as goods can be perched and shadings detected, with the white Moore light, as well as in daylight. Other uses are also being found for this form of light in department stores, studios, etc.



THE MOORE LIGHT FOR COLOR MATCHING.

The Moore Electrical Company, of Newark, N. J., supplies these lights in the form of long tubes and also make a semi-portable "Artificial Daylight" Moore light window as illustrated herewith.

This form is extremely well adapted to dye shop use and all other kinds of color matching.

Self-Soldering Wire Joints.

The "Ritetite" self-soldering wire joint which is being put on the market by the National Electric Specialty Company, Muskegon, Mich., and Toledo, O., is a combination of the two previously known methods of making a joint, but which does away with all twisting. A single instead of a double sleeve is employed, the wires are soldered inside the sleeve, and no torch or furnace is required, the necessary heat being supplied by a quantity of inflammable and intense heat producing material which is made up in manufacture on the outside of each tube.

In using, the wire to be soldered is first cleaned and acid or soldering paste is applied to it. The wire ends are then slipped into the tube as far as they will go. The inflammable material on the outside of the tube is then fired with a match. It flames with an intense heat and melts the solder inside of the tube, the wires are then shoved in, each one-half way, until they meet in the center of the tube. When cool the joint is completed.

The objection to a joint using solder has heretofore been that it is difficult to make in many cases, as well as costly. Soldering torches are notoriously troublesome, and out of order a great deal of the time, and it is impossible to use them on a pole top in even a moderate wind. So often they fail to generate at all, or the flame dies down before the job is fairly begun, and too many joints never are soldered, with the result that in a short time rusting begins, high resistance at the point of union developes, and trouble appears which is usually difficult to locate as well as costly. The "Ritetite" self-soldering joints eliminate this trouble. They are easily lighted; cannot be blown out when once fired; make a well soldered, non-rusting connection; are neat in appearance and are the ideal means of doing the work for which they are designed.

The self-soldering, line-duplex cartridge is a modification of the joint, and is for use in soldering the twist at the point where the iron or copper "drop" wires and the interior "duplex" wires are joined usually just outside the building in which telephones are located. This is a point of very great importance, and many cases of trouble are located here, due to a failure, perhaps in a wind when the installation was made, to solder them properly. The cartridge will also be found very useful in solder-

ing up the connections under chandeliers and canopies in electric light work.

These articles are, and should be, welcomed with enthusiasm by everybody in the electric business, and especially appreciated by practical men. Men who know how difficult it is to do soldering on a pole top or even on the ground, with a soldering torch, when there may be a wind of even low velocity, or the temperature is at perhaps zero.

Joints of good conductivity are absolutely necessary for efficiency transmission of the current, whether for the telephone, telegraph, electric light or messenger service. And as at present is the practice, much poor service and actual unnecessary expense are traceable to this source; there are too many corroded and high resistance joints in the lines. The "Ritetite" self-soldering joints and cartridges will obviate all this if used in each case.

Pelouze Tailor's Iron with Three Heats.

The Pelouze Electric Manufacturing Company, Chicago, Ill., is placing on the market a tailor's goose, shown in an accompanying illustration, for which is claimed high efficiency, great endurance—very quick starting ability—control of temperature, correct distribution of heat, very rugged mechanical structure, convenience in handling, and a three-heat switch.

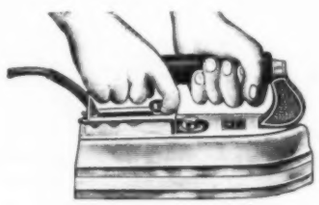
The requirements of a tailor's iron are more exacting than those of other irons. The faults more or less common to all other irons on the market are therefore more conspicuous in the tailor's iron.

If high efficiency is desirable in any iron it is much more so in the tailor's iron, because the large area of the bottom requires a greater volume of heat; also they are used a longer number of hours than are most smaller irons. It will, therefore, be seen that the quantity of energy required to do a given work becomes no small matter, and a saving is important.

It will be noted that many domestic irons on the market require from fifteen to twenty-two minutes to start. Many tailor's irons of the same manufacturers require from twenty to thirty minutes to reach the full ironing heat for wet pressing. It will be appreciated that such starting characteristics make the tailor's iron prohibitive in a job-shop where they are required often for only one job, taking perhaps five minutes to perform. The "Pelouze" tailor's iron requires only ten minutes to attain the maximum temperature.

It is a fact that the endurance of many tailor's irons on the market is only from four and one-half to twenty-four hours. The heating element of the "Pelouze" tailor's iron is designed in accordance with the same principles and characteristics, which make the "Domestic" irons so successful. They have practically an unlimited life.

The "Pelouze" tailor's iron is claimed to be one of the first irons placed on the market possessing three heats, all of which can be controlled with a simple motion of the hand while ironing, without withdrawing any plug from the iron, or turning any auxiliary switch, and also having its heaters so arranged that the heat is distributed over the bottom of the iron equally at any one of the three heats, and at the same time maintaining an equally high efficiency on all of the three heats.



PELOUZE TAILOR'S IRON.

The advantages claimed by the manufacturers of the tailor's iron possessing three heats, which can be controlled with a simple movement of the hand while ironing, are two-fold:

(1) It gives a greater range of temperature than can be obtained by ordinary switch-plug, or by other means.

(2) The low heat can be so arranged that the quantity of current consumed will just maintain the iron at an even temperature while standing indefinitely.

The first advantage is appreciated by manufacturers who have special temperature requirements and where the nature of the work varies greatly. The second is more important in job shops where an iron is more liable to burn out, as this feature would prevent such by allowing it to stand at low heat, instead of high. But as the "Pelouze" iron will not burn out, the chief advantages are that the iron is always maintained at just the correct temperature while standing between jobs. It never cools off or gets any hotter. This enables the operator to commence work at any time without waiting, whereas should the full heat be left on, omitting the question of consumption, it would become too hot.

The medium heat is used only when very light work is to be done, or where only one piece is to be pressed. For continuous wet work full heat is used.

The Wasson Double Reel.

Having had a number of applications for a reel to pay out two wires at a time the Wasson Reel Company, Clinton, Ill., has invented and recently placed on the market a reel for that purpose. It has been claimed that all double deck reels

THE WASSON DOUBLE REEL.

are not a success. This company has, however, overcome that, and has put out one which apparently is meeting with much success.

Views of this reel are shown in the accompanying illustrations. One is a view of the reel ready for transportation, and the other of the Wasson reel when ready for use. These reels are

WASSON REEL READY FOR OPERATION.

made so as to fold, thus enabling one to use the sidewalk and at the same time the reels are not top-heavy. Another advantage is that one man is able to transport the reel from one place to another with two coils of wire upon it, the load being perfectly balanced over the wheels.

Proposed Electric Railway.

A Swedish engineer has drawn up a project for the construction of an electric railway from Malmo to Copenhagen, passing under the Sound. The line will be about 147 miles long, with about ten miles of tunnel.

Some Recent Indirect-Illumination Installations.

As has been frequently pointed out, the ordinary direct methods of illumination, especially since the introduction of the tungsten lamp and other high-efficiency units, cause considerable distress of the eyes. Several methods of indirect illumination have therefore been evolved, among which is the well-known "I-Comfort" system, in which the lighting units are inclosed from direct observation by a reflector which throws the rays upward to the ceiling from which they are diffused to the area to be lighted in a manner approximating closely to the ideal effect of ordinary daylight.

Some recent installations of the I-Comfort system are shown in the accompanying illustrations.

Fig. 1 is a view of the auditorium of the South Shore Country Club, Chicago. The ceiling of this room is twenty-eight feet in height, and that of the twelve-foot promenade around the auditorium, and separated therefrom by the Ionic columns, is twenty feet high. This has been claimed to be the most beautiful illumination of any auditorium in the world.

Fig. 2 shows an optical goods store on State Street, Chicago. This store is twenty-seven feet wide, fifty feet deep, and the ceiling is sixteen feet high. The same fixtures were formerly used, the sockets being turned downward. With the indirect system the arms were simply reversed, or pointed upward, and adaptables slipped over the sockets, each adaptable containing the corrugated silvered reflector inclosed in a brass casing and containing a 100-watt lamp.

Fig. 3 is a photograph of a hotel dining room. This room is twenty-eight feet square with a ceiling eighteen feet in height. The four fixtures contain in all twelve 100-watt tungsten lamps and company used 100-watt tungsten lamps in each fixture which is hung in the center of an imaginary twelve-foot square. As the office force became used to this method of illumination it was found that less brilliancy of light would be ample and accordingly the 100-watt units were replaced by sixty-watt lamps.

Fig. 4 shows one of a suite of offices in the Home Insurance Building, Chicago, all of these offices being equipped with this method. A noticeable feature is the entire absence of drop cords and individual disk lights. At first this give most satisfactory illumination in marked contrast to the glaring direct illumination formerly used.

FIG. 1. ILLUMINATION OF AUDITORIUM, SOUTH SHORE CLUB.

FIG. 2. ILLUMINATION OF AN OPTICAL GOODS STORE.

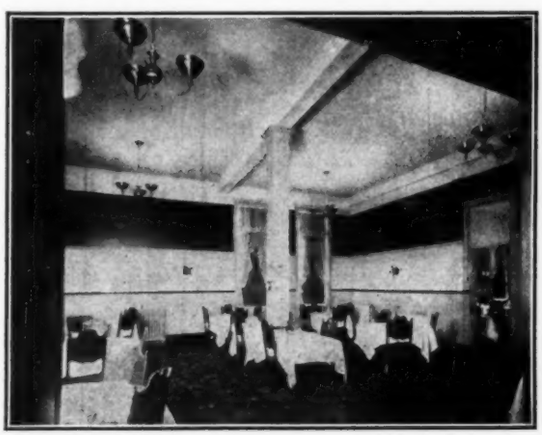


FIG. 3. INDIRECT ILLUMINATION OF A TYPICAL HOTEL DINING ROOM.

FIG. 4. ILLUMINATION OF SUITE OF OFFICES, HOME INSURANCE BUILDING.

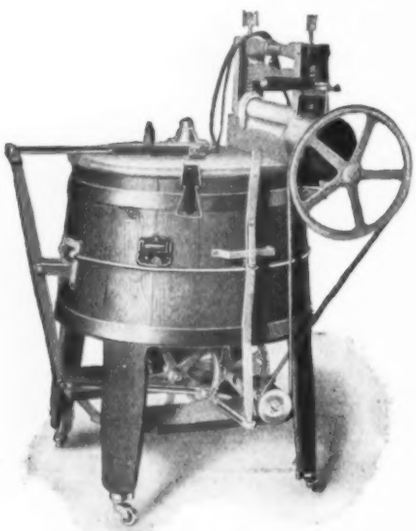
Talks Wirelessly 200 Miles.

A report from Pittsburg states that Prof. R. A. Fessenden has succeeded in telephoning wirelessly over a distance of more than 200 miles from his wireless station at Brant Rock, Mass.

An Automatic Electric Washer.

The electric washer illustrated and described herewith, has been introduced not only as a much needed public convenience but also as a vehicle whereby electric central-station companies may materially increase their day loads and so improve their load factors. As has been frequently pointed out, the selling profit on such current-consuming machines is of secondary consideration compared with the profit on the current which they use and which is almost invariably utilized during the off-peak hours.

This electric washer, which is manufactured by the Automatic Electric Washer Company, of Newton, Iowa, is the result of much care and experiment in design, and the results, both from a practical and artistic standpoint, are all that could be desired.



AUTOMATIC ELECTRIC WASHER.

The motor has been specially selected for the kind of duty which devolves on it in this machine, and is capable of taking care of any ordinary sudden and severe overload which may occur in the operation of wringing. Special precautions are taken before the machines leave the factory to prevent short-circuits, sparking, and other troubles associated with electric motors.

A noteworthy feature of the automatic electric wringer is the gear drive which replaces the ordinary motor belt. This includes an expensive raw-hide pinion and a cut gear, by which an almost noiseless drive is assured. Concentric with the cut gear, but loose upon the shaft is a collar terminating in a small pinion on one end and fitted with a clutch on the other. This pinion in turn meshes with a larger gear wheel to which is attached the pitman driving the washer. Motion is transmitted to the small pinion by a sliding clutch revolving with the shaft and shifted by the side lever. A movement of the lever to the vertical position releases the clutch and the motor runs light. By the same operation the motor starts under no load. A forward shift of the lever toward the wringer causes the clutch to engage the small wheel on the outer end of the shaft, driving the wringer belt. This delivers power to the large wringer wheel, and the operation of the wringer may then be entirely controlled by the reversing lever. As shown by the illustration, the wringer gearing is actuated by the small sliding clutch shifted to forward, neutral or reverse, by the small lever fastened to the wringer frame. The wringer also has an extra wide guide board to prevent clothes from wrapping around the rolls. The reversing gearing is enclosed in a substantial shield, affording perfect protection to fingers and clothing.

The motor speed is about 1,750 or 1,800 revolutions per minute and the washer makes from fifty-five to sixty strokes per minute—a reduction of thirty to one.

All working parts are mounted upon a separate platform beneath the tub, strengthening the whole structure and placing the motor safely away from drippings. This feature is completely protected by patents, and is therefore exclusive. There is no bevel gearing, and no flywheel. Nothing whatever is fastened to the bottom of the tub. The motor is provided with eight feet of heavily insulated show window cord, anchored to the machine by porcelain cleats, giving perfect protection to the motor terminals.

The washing is performed by the ordinary dolly and four pegs within the tub, revolving in semicircles at each stroke of the rack bar on top. This motion occurring sixty times per minute causes cleansing currents of soapy water to circulate through and around the clothes. A steam-tight cover for the tub prevents the escape of vapor.

The entire machine weighs 150 pounds crated, and is provided with ball-bearing casters, making it an easy matter to move it about.

Detroit Fuse and Manufacturing Company's New Factory.

The increasing demand for "Arkless" enclosed fuses and "Detroit" ironclad switches, the well-known products of the Detroit Fuse and Manufacturing Company, Detroit, Mich., has necessitated a progressive expanding of the company's manufacturing facilities, the facilities afforded by the large factory heretofore occupied by the company having been for some time inadequate. In order to place themselves in a position to promptly fill orders, the company not long ago secured an extensive building site in one of the principal manufacturing centers of Detroit, 1400 Rivard Street, and have just completed the erection of a modern factory building, a view of which is shown herewith. The equipment of the new factory, both in machinery and method, is thoroughly up to date. All the machinery is new and of the most approved types and of sufficient capacity to enable the company to promptly take care for a considerable period of time of its steadily increasing orders.

NEW FACTORY OF DETROIT FUSE AND MANUFACTURING COMPANY.

Motors aggregating seventy horsepower furnish the power and provision has been made for all necessary additions to the factory which may be necessary in the future.

Among interesting features of the new factory are a finely equipped tool department for the manufacture and maintenance of tools and dies, an electrical laboratory for the testing of "Arkless" fuses before shipment, as well as for experimenting and development work; also a complete drafting department for work in connection with the "Detroit" line of ironclad switches, a type of switch that possesses features of striking interest and that is meeting with decided favor in the field, judging from the number of orders received.

Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, DECEMBER 18.—The summonses taken out against the Welsbach Incandescent Gas Light Company by the General Electric Company, for selling metal-filament lamps marked in such a way—combined with certain advertisements—as to lead people to think that they were Osram lamps, have been withdrawn. It appears that the parties came to an agreement for the withdrawal of the advertisements complained of, but the lamps will continue to be called "Aur" lamps. It seems that such an agreement could have been arrived at without any proceedings whatever. The cost must have been enormous, in view of the eminent counsel engaged. Nevertheless I understand that patent proceedings will be taken against the makers of the lamps sold by the Welsbach Company.

The Mersey Docks and Harbor Board, Liverpool, has always been very progressive in the use of wireless telegraphy. The latest proposal is to equip all light vessels and lighthouses with wireless and to have a wireless station on the roof of the large new Dock Board offices which are now rapidly approaching completion.

Doctor Fleming gave a very interesting lecture before the Institution of Electrical Engineers on Thursday, in which he dealt with his recent experiments in wireless telegraphy. Making use of the inductance of flat spiral springs, he has applied it in tuning coils for radiotelegraph receivers and transmitters. He showed a receiver made on this principle. He also exhibited a quadruple flat spiral coil of which the inductance could be varied from 28,000 to about 330,000 without any change in resistance. A pair of flat spirals moving over one another with planes parallel, has the peculiar characteristic, he showed, that the mutual inductance can be varied from a maximum value down to an absolute zero, by quite a small sliding of one coil over the other. Taking advantage of these facts with regard to flat spirals, he has had constructed a very compact radiotelegraphic receiving circuit consisting of variable inductance, oscillation of variable coupling and variable condenser, with which can be detected electric waves of any wave length between 300 and 4,000 metres. He has also devised a photographic spark counter to photograph the oscillatory spark at the spark balls of a radiotelegraphic transmitter. He exhibited a number of photographs taken with this counter, which revealed for the first time to the eye the processes actually taking place in the spark gap of radiotelegraphic transmitter. Doctor Fleming has also evolved a differential electric thermometer for high-frequency resistance measurement.

The inaugural meeting of the new Institution of Mining Electrical Engineers is to be held this week end at Manchester.

A short length of surface contact tramway on the "S. P." system is to be installed at Dover." G.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, December 26.—A calculation has been made showing the possible earnings of the Toronto Street Railway in 1921. Mr. Clark, the assistant comptroller, has made a chart, which indicates gross earnings of $20,000,000, in 1921, and net earnings of $9,000,000. The gross earnings, this year, will be about $4,000,000.

Federal disallowance of the hydroelectric power legislation of the Ontario government has been asked of Sir Wilfrid Laurier by I. G. Hutchins, of New York, representing N. W. Harris & Company, of that city. It was urged that the hydroelectric scheme imperiled investments in Dominion Power and Transmission Company. The whole matter is under consideration of the Dominion government.

The directors of the Shawinigan Water and Power Company have authorized an issue of 5,000 shares of common stock, being the balance of the unissued capital stock of the company. The shareholders will get one new share for every thirteen shares of old stock now held. The present capital of the concern is $6,500,000, and the new issue brings it up to the authorized amount of $7,000,000.

Representatives of the governments of New Brunswick and Quebec, and of prominent lumber companies, have been in Ottawa to urge before the Dominion Railway Commission the advisability of using electric motive power on the Grand Trunk Pacific Railway through the province of New Brunswick. One of the chief objects involved in the proposal to use electricity is the protection from fire of the vast forests through which the railway line passes. It is proposed that the power for operating the line be obtained from the Grand Falls on the St. John.

It is said that those in control of the Toronto Street Railway are sounding the leading brokers of the Montreal Stock Exchange, as to how a big issue of securities of the railway company would be received by Montreal investors. A good deal is said to depend on whether a new arrangement as to franchises, could be made with the city of Toronto. If a new agreement could be brought about, with a franchise for the radials, it is said that over $20,000,000 could be cleaned up for the promoters in a very short time.

Another increase in capital is contemplated by the directors of the Mexican Power Company. The shareholders are being notified by circular of a special meeting called to agree to the proposed increase. The directors will ask authority to issue $3,000,000 seven per cent. preferred stock and $5,400,000 common. This will make six millions preferred and nineteen millions common when all is issued. The business of the company has grown very rapidly, and the original installation of 50,000 horsepower was found to be inadequate to supply the demands of the district served by the company. To meet these demands, and to provide for future growth, it was decided to increase the capacity of the hydraulic plant to 100,000 horsepower. The directors say that the bulk of the work will be completed in 1910.

Rudolph Forget, who has had charge of all negotiations in connection with the merger of the public utilities companies of the city of Quebec, now included in the Quebec Railway, Light, Heat and Power Company, makes the following official statement: "All negotiations are now completed, and the following companies will be included in the merger: The Quebec Railway, Light and Power Company, the Quebec Jacques Cartier Electric Company, the Canadian Electric Light Company, the Quebec Gas Company and the Frontenac Gas Company. The new concern has an authorized capital of $10,000,000 of stock and $10,000,000 of bonds. Of the stock, it is intended to issue $9,500,000, and of the bonds, $8,654,600. The amount of the bonds available for underwriting was $4,200,000, and nearly all of this has been taken in firm subscriptions, so that there will not likely be any offering whatever.

The most expert engineers of a leading Canadian electrical corporation, who have been engaged to furnish data for the construction and cost of the new tunnel which the Canadian Pacific Railway Company proposes to build, connecting its two big stations in Montreal, the Windsor and Place Viger stations, have completed their work and sent their report to the management in whose hands it will remain until the return of the president of the company, Sir Thomas Shaughnessy, from his trip to Europe. The extension of the terminal facilities, at the two stations, and the excavations in progress, render the enterprise quite feasible and practicable with modern railway services at the great depth mentioned. Handsome and swift traveling elevators will take the public down to the beautifully illuminated double-track subterranean railway which will operate on the floor of the tunnel. The tunnel itself will be of the standard width and height. The idea is to use the electric system for the rapid transit of passengers during the day, and for the haulage of freight during the night.

The Municipal electric light plant of this city shows a profit for the year of $20,000 and an increase of mileage of its wires.

The directors of the Bell Telephone Company of Canada have declared the regular quarterly dividend of two per cent, payable January 15, 1910.

The bill of the Toronto Terminal Company, which is now before the Dominion Parliament, contains a full list of the provisional directors among whom is included Fred H. Allen of New York. The clause empowering the company to enter into agreements with other companies, names all the steam and electric companies doing business in and about Toronto, including the Toronto Railway Company.

Only about 2,800 property owners in the city of Montreal, out of a total of over 20,000, voted on the referendum on the expenditure of $2,000,000 for a municipal electric light plant. The proposition carried by a majority of 365, the French wards voting in favor and the English wards voting against the proposition. The referendum was purely advisory, and the City Council will likely leave the matter to their successors of February next, when the new board of control will be inaugurated.

There is said to be little doubt that negotiations towards the amalgamation of the chief public utility companies, operating in the city of Montreal, are under way. It is stated that plans are maturing towards the consolidation of the Light, Heat and Power Company and the street railway company, the Shawinigan company to be brought in at a later date. No one can say, at this juncture, just what the terms of the merger will be between the three concerns, as the officials refuse to say anything for publication.

According to advices from London, Ont., a move of first importance in the Niagara power fight, and which is regarded as a combination of the various electric and railway interests to kill the

Hydroelectric plans, is the prospective purchase by a syndicate of the Cataract Power Company, the Southwestern Traction, the Grand Valley Railway, and the London Electric companies. Murray A. Verner, of Pittsburg, Pa., president of the Grand Valley Railway, and W. S. Dinneck, of Toronto, have been in London in connection with the matter. The merging of these interests would give the syndicate control of the sale of power in the cities of Hamilton, Brantford, Woodstock, Ingersoll, London, and intermediate points, with a chain of radial lines from Hamilton to Port Stanley, and a fleet of boats operating on Lake Erie.

For some time past, engineers have been engaged on a project to secure power from the Saskatchewan River, and, after a thorough investigation of the upper stretches of the river, a point 110 miles from Edmonton, has been decided upon. Charles Tupper, B. S. C., of McGill University, Montreal, son of Sir Chas. Hibbert Tupper, and Charles H. Colgrove, M. E., have been conducting the investigations. Mr. Colgrove has been connected with large plants in Colorado, New Mexico and Idaho. The estimated cost of the project is about $1,500,000. The minimum power that can be generated is estimated at 20,000 horsepower, and the maximum is much larger. This big electric power scheme is now being considered by a group of hydraulic engineers. It is expected that Montreal capitalists will be identified with the project.

One of the greatest assets that a town or city can have is a good supply of cheap electric power, both for lighting and power purposes. The town of New Liskeard, Ont., ten miles north of the Cobalt district, on the Temiskamingue & Northern Ontario Railway, is especially favored in this respect. From the power plant, on the Wabi River, a distance of about twelve miles from the town, New Liskeard gets its power for manufacturing purposes at the low rate of $18 per horsepower per year. W.

LIGHTING AND POWER.

(Special Correspondence.)

SAN JACINTO, CAL.—An appropriation has been made by the government for an electric lighting plant on the Indian reservation at Soboba. A.

SANTA ROSA, CAL.—The Board of Supervisors at their last meeting granted the franchise petitioned for by the Coverdale Light and Power Company to that corporation. A.

COMPTON, CAL.—W. L. Frew and W. G. Logg of the Consolidated Utilities Company, have asked the Board of Trustees for an electric light franchise in this city. Sealed bids will be received up to January 4 for the franchise.

DECATUR, ILL.—The Progressive Light and Power Company has been incorporated with a capital of $100,000 to furnish power for electric lighting. The incorporators are: William H. Suffern, Robert I. Hunt and Fred M. Ives, all of Decatur.

RAY, ARIZ.—The Ray Consolidated Copper Company is preparing to install a subsidiary electric power plant at its main working shaft in order to prosecute development on ore bodies until the main electrical plant is completed at Winklemen. A.

FORT WAYNE, IND.—The Board of Public Works has appropriated $50,000 out of the general fund for the purpose of installing a new 1,000 or 1,200-kilowatt turbine unit generator in the municipal light and power plant. The lines of the plant will also be extended. S.

SNOHOMISH, WASH.—Articles of incorporation of the Snohomish Electric Company have been filed for J. E. Wickstrom, Wilbur J. Wickstrom and J. E. Small as trustees. The new company's capital stock is named at $200,000, and its articles cover all uses of electricity.

GREAT FALLS, MONT.—The Great Falls Water Power and Townsite Company has recently purchased six 200-kilowatt and three 150-kilowatt transformers for installation in their station at Black Eagle, Mont. The transformers are furnished by the Allis-Chalmers Company of Milwaukee, Wis.

SANTA ROSA, CAL.—A franchise has been recently granted to the Cloverdale Light and Power Company of this city. The company intends to distribute electricity for light and commercial purposes all over the northern section of the county, in every direction. The work is to be begun in the near future.

REDWOOD CITY, CAL.—Attorney Archer Kincaid on behalf of Benjamin Cunha, has presented a petition asking that steps be taken to sell a franchise for installing and maintaining electric lights in Miramar, Halfmoon Bay and Pursima school districts. The Board of Supervisors postponed action until its next meeting. A.

INDIANAPOLIS, IND.—The Merchants Heat and Light Company is proposing to erect artistic electric light poles in the business center of the city—each pole to carry five lights—without cost to the city. Edward McKee, president of the new company, says arrangement has been made with the business people to bear the expense. S.

TOLEDO, OHIO.—An 1800-horsepower turbine engine has been installed in the Western Ohio power house at St. Marys, Ohio, which with a 1500-horsepower compound engine, is furnishing the current formerly generated by two large compound engines and two small engines. Coal consumption has dropped from ninety tons per day to seventy-five tons. A.

PONTIAC, MICH.—The Pontiac Light Company will spend $50,000 to double the capacity of its electric lighting plant at once. The company has accepted a two-year contract to supply all the current used for power and lighting by the Oakland Motor Car Company. Other big contracts which are expected made it necessary to make the improvements.

LOUISVILLE, KY.—Articles of incorporation of the Southern Hydroelectric Company, with headquarters in Harrodsburg, have been filed with the Secretary of State. George Fetter, of Louisville, is one of the chief stockholders. The company expects to dam the Dix River in Mercer County and sell electrical power to Harrodsburg, Richmond and other cities.

GREGORY, NEB.—A company of local men has been formed, and capitalized at $20,000, for the purpose of furnishing electric light to this city. The following officers have been elected: President, W. H. Tackett; vice-president, J. Reuther; treasurer, John P. Biehn; secretary, Edward Morrison; directors, W. H. Tackett, L. Q. Loyd, J. Reuther, Edward Morrison, P. Myrick.

WAYCROSS, GA.—A deposit of $10,000 in cash and bonds has been made by Burdette Loomis, Jr., of Hartford, Conn., with the city to guarantee the carrying out of a franchise to build an electric lighting plant in Waycross. The plant is to be started within three months and is to be complete within one year. The company proposes to reduce the cost of lighting and fuel gas about 35 per cent. A rate of $1 per 1,000 feet for gas has been promised. L.

GRAND FORKS.—The City Council has decided to proceed with installation of additional equipment for the municipal lighting plant to provide for illumination of the streets of the entire business section of the city by the new system. The plans include the placing of eight ornamental posts, bearing five tungsten lamps each for every block. The cost of additional equipment will reach $35,000, and will make Grand Forks the best lighted city in the entire northwest.

INDIANAPOLIS, IND.—The Municipal Light and Power Company has incorporated with a capital of $25,000. The company proposes to construct, equip and operate light, heat and power plants in towns of the third class, and also install plants in such towns for the supplying of light and power and transmitting the current thereto from larger plants. The first plant will be built at Pendleton, Indiana. The incorporators are: Ira M. Holmes, Harry Holmes, William Holmes, J. B. Parsons and J. B. Taylor. S.

HOLSOPPLE, PA.—The White Oak Light, Heat & Power Company, of Holsopple, has been chartered with a capitalization of $20,000. The stock is divided into 200 shares, which are held by Joseph Cauffiel, of Johnstown; C. C. Zimmerman, Emanuel Eash, Hiram W. Lint, Mahlon Keim, Aaron Miller and William Baer, all of Holsopple; Daniel Yoder, H. J. Spaugy, Charles Naugle, and Joseph Naugle, all of Hooversville. The company is now installing a fifty-horsepower water-driven turbine.

FULTON, KY.—According to a decision rendered by the Court of Appeals, the Fulton Electric and Power Company's local plant is to be sold at public auction. The stockholders controlling fifty per cent of the outstanding stock, C. E. Rice, Joe Browder, R. A. Freeman and J. H. McClure, petitioned the court to take the plant from the possession of L. W. Graham, who owns the other fifty per cent, and sell it at auction in order that the dispute over the management be settled. The plant is valued at about $45,000 and is the only source of electric power in Fulton.

ELKHART, IND.—The Elkhart Gas Power Company has been formed to compete with the Indiana and Michigan Hydroelectric Power Company. Local manufacturers are back of the enterprise. They propose to build and equip a plant for the supplying of power and light. The plan is to generate electricity with gasoline power and distribute it to the manufacturing plants desiring it. C. E. Fry, of the Elkhart Bristol Board Mill Company, is at the head of the new company. The recent increase in the rates charged by the Hydroelectric company is said to occasion the organization of the independent company.

JAMESTOWN, N. Y.—The Broadhead Brothers, of Jamestown, N. Y., the principal owners of the Jamestown Street Railway Company and the Chautauqua Traction Company, have purchased for $90,000 the fifty-year franchise and plant of the Jamestown Lighting and Power Company. It is reported that the new company will use power generated at Niagara Falls, as the power already reaches Dunkirk, N. Y., over the wires of the Buffalo & Lake Erie Traction Company. If this power is brought to Jamestown, as now seems probable, it will be delivered to the Chautauqua Traction Company's power station at Mayville.

SAN FRANCISCO, CAL.—Articles of incorporation of the Mount Shasta Power Company, organized to develop electric power on the Pitt River, have recently been filed. The company is capitalized at $1,000,000. It has been formed to take over and combine the interests of a number of owners of water rights on the Pitt River. It is proposed to construct dams and erect machinery for the generation of electricity. Probably $2,000,000 will be expended in developing the rights taken over by the company. Those most largely interested in the project are John Coffee Hays of Visalia, William A. Cooper and R. C. Johnson of San Francisco, H. V. Gates of Hillsboro, Cal.

YUKON, OKLA.—The Yukon Electric Company has been incorporated with a capital stock of $5,000. P.

PORTLAND, ORE.—J. M. McIntyre and Edward McIntosh have secured a power and lighting franchise for Yacolt, a town in the northern part of Clark County, Wash.

KALISPEL, MONT.—The Root Mountain Water Power Company has been incorporated with a capital of $100,000, and will put in an electric plant. P.

TOWNSEND, MONT.—C. S. Muffly, J. A. Matthews, E. H. Goodman, A. Stafford and S. Wisemiller have organized the Townsend Waterpower and Electric Company. C.

CHIHUAHUA, MEX.—Diego Redo, Governor of Sinaloa, has been authorized to utilize for motor power the current of the San Lorenzo River. The work of diverting the current will begin in April. A.

BEACH, N. D.—Geo. Chrysler, superintendent of the electric light plant at Wadena, Minn., has applied to the council for a franchise to install an electric light plant here. C.

LA CROSSE, WIS.—The La Crosse Water Power Company will build a 200-foot dam at Rock Creek, near Waterbury, and quadruple its reservoir capacity. C.

DES MOINES, IOWA.—A movement is on foot to secure the widening of the dam of the Electric Light Company across the Des Moines River at Center Street. C.

HECLA, S. D.—Twaddle Bros. are to install an electric lighting plant in their feed mill on Second avenue to supply the town and business houses with light. C.

REDDING, CAL.—Articles of incorporation have been filed by the Mount Shasta Power Company, organized to develop electric power on the Pitt River. The company has been capitalized at $1,000,000. A.

GRAND FORKS, N. D.—The council has decided to proceed with the installation of a complete electric light plant at the city power house in order to furnish current for street lighting and commercial service. C.

NASHVILLE, TENN.—The Markwood Power Developing Company has been incorporated with a capital of $20,000 by the following men: A. T. Markwood, C. E. Burchfield, A. A. Taylor, W. H. Martin and S. C. Williams.

REIDSVILLE, N. C.—The new city electric light buildings are now under construction, and three boilers will be installed, capable of generating 375 horsepower. The foundations for the boilers, dynamos and other machinery will be of solid concrete. L.

RACCOON, GA.—It is reported that Stewart-McCord Company of Savannah, Ga., is figuring on the development of water power and construction at Raccoon of plants to transmit electricity for operating Raccoon Mills and for lighting purposes as well. B.

EVANSVILLE, IND.—The recently incorporated Public Service Company has selected a site at Sixth and Canal Streets upon which to erect and equip a new central heating and electric light plant. Bids will be in order soon. S.

STILLWATER, MINN.—The Washington County Light and Power Company has increased its capital from $100,000 to $1,000,000 and will increase its facilities for furnishing light and power as well as extend its operations to other cities. C.

HETTINGER, N. D.—C. A. Meyer, of Clarkfield, Minn., and Elmore L. Edson, of Minneapolis, who are doing business under the name of the Hettinger Electric Power Company, have applied to the council for a franchise to install an electric light plant. C.

SAVANNAH, GA.—The Savannah Hydroelectric Company of Savannah, Ga., has been incorporated with a capital stock of $300,000 and proposes to build a hydroelectric plant on the Connooene River, forty miles from Savannah. D. G. Zeigler & Company of Jacksonville, Fla., are the engineers.

CORDELE, GA.—H. S. Marshall of Illinois, D. G. Zeiger of Jacksonville, Fla., G. W. Hatcher of Cordele, Ga., and associates have applied for a charter to construct a waterpower development plant on the Flint River. It is proposed to transmit 9,000 electric horsepower to Cordele and Americus, Ga. B.

MINNEAPOLIS, MINN.—The city will pay half the additional cost of the erection of a high power dam across the Mississippi river at the Soldiers home, estimated at $225,000, and it is expected that the city of St. Paul will pay the other half. The dam will be thirty feet high and will create 9,000 to 15,000 horsepower. C.

SALT LAKE CITY, UTAH.—Moses W. Taylor of Coalville has filed an application with the state engineer for the right to appropriate twenty-two feet of water from Chalk Creek, Summit County, for the purpose of supplying electrical motive power to various towns in Utah. A.

NEILLSVILLE, WIS.—The Upham Manufacturing Company is planning to install an electric power plant on the Black River here to develop 400 horsepower. The Upham Manufacturing Company proposes to use 250 horsepower, and the Spaar Cereal Company is said to be desirous of using the remaining 150 horsepower to run its flour mill. M.

INDIANAPOLIS, IND.—The Merchants' Heat and Light Company has obtained consent of the city council to erect lamp posts on Washington Street, the cost of current to be maintained by the merchants. The generous offer of the company will save the city about $12,000 a year. S.

TOWNSEND, MONT.—The Townsend Water Power and Electric Company has been organized by C. S. Muffly, J. A. Matthews, E. H. Goodman, A. A. Stafford and S. Wisemiller, with a capital of $40,000 to supply neighboring towns and mines with electric power. Work has already been commenced on the construction of a dam across a branch of the Missouri River. C.

GREENVILLE, S. C.—The transmission lines of the Southern Power Company from the Great Falls plant, on the Catawba River, about eighty miles distant, are being completed and the electric lights for the Monaghan mill village have been turned on. The mill is now being partially operated by the electric current, and the entire plant will soon be driven by the transmitted power. The Woodsides mills will also use electricity for motive power. L.

MARIETTA, GA.—Part of the $80,000 bond issue voted some time ago for the improvement of the municipal plant will be expended for an electrical generating unit. The Board of Water Commissioners has ordered from the Allis-Chalmers Company, Milwaukee, a 16 by 36 non-condensing engine direct-connected to a 175-kilowatt, sixty-cycle, three-phase, 2,300-volt, generator. The new installation will also include an exciter and a switchboard of Blue Vermont marble with the usual equipment.

ALBANY, N. Y.—The Public Service Commission, Second District, has authorized the Northern Westchester Lighting Company of Ossining to issue $124,000 five per cent gold bonds maturing June 1, 1950. The bonds are to be sold at not less than ninety per cent of their par value. The capital to be secured by the sale of the bonds is to be used to discharge indebtedness of the company incurred in making certain additions and betterments to its plant and distributing system.

GREEN BAY, WIS.—A trust deed of $5,000,000 on the property of the Northern Hydro-Electric Power Company has just been recorded. The negotiations were handled by E. L. Myers and George B. Caldwell, of Chicago, both of whom are directors of the company. Mr. Myers has also been elected vice-president of the Green Bay Traction Company and the Green Bay Gas and Electric Company, both allied with the power company, and will give his personal attention to the direction and management of the properties.

ATHENS, GA.—To develop the waterpower at Barnett Shoals, the Athens Railway Company will extend its line thereto and arrange a park at the terminus. It is stated that this power at Barnett Shoals will be developed by James White, W. T. Bryan, J. Y. Carithers and associates, that the proposed dam will provide a fall of fifty feet and that 5,000 horsepower will be developed. A portion of this power to be used by the Athens Railway Company and the remainder of the power developed will be used for general industrial purposes. It is stated further that C. D. Flanigan of the Athens Railway Company will be chief engineer and together with James White Morton of Athens will have charge of this development.

ELECTRIC RAILWAYS.

(Special Correspondence.)

ARCADIA, WIS.—An effort will be made to secure the construction of the interurban road to be built by the La Crosse & Winona Traction Company through this town. C.

LA CROSSE, WIS.—The council granted a franchise to the La Crosse & Winona Traction Company for an interurban road. It will be running into Galesville within two years and will ultimately be extended to Minneapolis and St. Paul. C.

FORT WAYNE, IND.—The Fort Wayne & Wabash Valley Traction Company is building a new sixty-two-foot interurban car in its local shops. This is the largest piece work ever undertaken by the company and when completed will be the largest interurban car in the middle west. S.

CONNERSVILLE, IND.—A. M. Kuhn, of Indianapolis, president of the Columbus, Greensburg & Richmond Traction Company, addressed a meeting held in this city December 17, in which he stated arrangements were being made for a bond issue and that the road would be built between the above named cities. S.

MENTONE, IND.—Rapid progress is being made in the work of completing a twelve-mile gap on the Winona Interurban line between this city and Chili. Sixty carloads of steel rails have arrived and as soon as laid service will be opened between South Bend and Peru and making trolley connection from Chicago to Indianapolis and Louisville possible. S.

SOUTH BEND, IND.—A bond issue of $1,000,000 will soon be put on the market by the South Bend & Logansport Traction Company which is building a traction line from South Bend and Logansport. Subcontracts have been let for the construction of the line as follows: Southern part, to the Triad Engineering and Construction Company; middle part, to U. S. Litgart, and the northern portion including entrance into South Bend, to Redd and Sons of Mishawako. David Pepper, Jr., of Philadelphia, with offices in South Bend, is the general contractor for the construction of the road. The Illinois Steel Company has contracted to furnish the rails. The contracts for the ties, poles and wire are yet to be let. S.

IOWA CITY, IA.—The Iowa City, Ottumwa & Southwestern Electric Railway Company has been incorporated to build a line to Ottumwa. P.

FORT DODGE, IOWA.—L. S. Cass, formerly with the Great Western railroad, is planning the construction of an electric interurban to Mason City and Waterloo. C.

JANESVILLE, WIS.—The survey has been commenced for the electric line which the Chicago & Wisconsin Valley railroad proposes to build north to Merrill at an estimated cost of $4,000,000. C.

DES MOINES, IOWA.—The Railroad Promotion and Construction Company of Des Moines, Charles Philpot, secretary, has been incorporated to construct railroads operated by electricity, gasoline, steam, etc.

CLAREMONT, CAL.—A petition signed by sixty-five property owners asking a postponement of the sale of the franchise for an electric railway between Pomona and Claremont has been presented to the Council. A.

NEW ROCHELLE, N. Y.—The Shore Line Electric Railroad Company has been incorporated at Albany, N. Y., with a capital of $300,000. The incorporators are: F. L. Babcock, E. A. Maher and R. Martin, New York city.

MACON, GA.—It is reported that the Macon Railway & Light Company will make various improvements during the coming year, such as completing a line out the Columbus road; extending the South Macon line one mile and extension of the East Macon line one mile. B.

BEAUMONT, TEX.—The Uvalde and Leona Valley Interurban Railway Company has been incorporated with a capital of $50,000 to construct an interurban electric railway between Uvalde and Sansom. The incorporators are Charles Peterson, A. M. Avant, M. M. McFarland.

BOZEMAN, MONT.—The preliminary survey of the proposed extension of the Gallatin Valley Electric Railway from the Bozeman Hot Springs through Belgrade and for a distance of fifteen miles up Dry Creek has been completed and the figures secured are now in the hands of the directors.

REDWOOD CITY, CAL.—A survey for an electric line across the mountain to La Honda and the Big Basin. The proposed road will run from a point of deep water through Redwood City and directly to Woodside. The approximate cost of the proposed railroad is estimated at $1,000,000.

WINSTON-SALEM, N. C.—Application has been made for a charter for the Yadkin River Railway Company. The plan of the promoters is to build an electric railway from East Bend to Donnaha, Yadkinsville and Winston-Salem. The charter provides for work to begin on the enterprise within two years.

SAN ANTONIO, TEX.—Work was recently started on the extension of the West Commerce Street car line, which will run from Prospect Hill to Lake View addition, a distance of three miles and a half. The traction company expects to have the new stretch of track completed and thrown open to traffic within a few months.

ALBANY, N. Y.—The Shore Line Electric Railroad has been incorporated with the Secretary of State as a reorganization of the Tarrytown, White Plains & Mamaroneck Railway sold under foreclosure recently, and a capital of $300,000. The directors include Edward A. Maher, F. L. Babcock, E. G. Merrill and Dudley Olcott of New York.

COAL RUN, W. VA.—It is expected that in a very short time cars on the Muskingum division on the Parkersburg, Marietta and Interurban electric road will be running between Coal Run and Marietta. The trestles between Lowell and Coal Run are practically completed, most of the grading is done and the tracks are laid for the greater portion of the distance.

MARSHFIELD, ORE.—J. M. Blake has been granted a franchise for construction and maintenance of an electric railway within the limits of the city. The line is one which is to connect the cities on the bay. It is understood that Eastern capital will finance the project. The initial construction will mean an expenditure of about $100,000, and will include five miles of road.

WASHINGTON, D. C.—The Washington, Spa Spring & Gretta Railroad Company, upon whose line work has been started on the Bladensburg road, is to extend a distance of about seven miles from Branchville, Md., to the intersection of Fifteenth and H streets northeast, in the city of Washington, where its passengers will be able to take the H Street line into the heart of the city.

COLUMBIA, S. C.—The Columbia Street Railway Company has closed a contract for the equipping of their electric cars with the pay-as-you-enter device manufactured in New York. David Murdock, representing the manufacturers, closed the deal with the Columbia Electric Railway Company. It is understood that a number of other cities in the south will adopt the same system, which is comparatively new in the south. L.

BRISTOL, WASH.—Contingent upon securing a grade of four per cent or less, a New Jersey syndicate has agreed to build an electric line from White Salmon or Bingen, on the Columbia River north to Snowden, a distance of about sixteen miles. The route of the proposed line runs up Wilkeson Canyon, through Pine Flat, about two and a half miles north of Bristol, and thence to Snowden. It will open up a large stretch of productive country.

VALPARAISO, IND.—The Gary-Hobart-Valparaiso Traction Company has now been fully organized and is in financial shape to begin the construction of its interurban line from here to Gary, a distance of sixteen and one-half miles. The right-of-way on its own land has been secured by the company for nearly the entire distance between the two cities. The company is capitalized for $500,000, of which $400,000 is common stock and $100,000 is preferred.

MACON, GA.—During the coming year the Macon Railway and Light Company will extend its line out further into South Macon, East Macon and out the Columbus road. It is planned to take the South Macon line fully a mile further south and extend the East Macon line as far as the Outing and the Recreations clubs. This year the company has improved its plant by adding a new $60,000 turbine and it has also reduced the consumer's rate on lights.

PHOENIXVILLE, PA.—An application for a charter for the Phoenixville, Valley Forge & Strafford Street Railway Company has been approved. The new line will be ten miles long, connecting Phoenixville with Strafford by way of Valley Forge. The capital is $60,000, and the incorporators are Thomas E. O'Connell, of West Chester, president; O. E. Thomson, John A. Dismant, C. F. Boden, Samuel W. Deininger, A. W. Kley, H. H. Gilkyson, Jr., E. C. Meir and I. E. Miller, Phoenixville.

DES MOINES, IA.—Articles of incorporation of the "Railroad Promotion and Construction Company" have been filed with the county recorder of Polk County. The purposes of the corporation are stated to be to promote and construct railroads, operated by electricity, gasoline, steam or other motive power. The officers of the corporation are, H. H. Polk, president; Wm. Moran, vice-president; Chas. H. Philpot, secretary; O. P. Herrick, treasurer; A. P. Chamberlain, general manager.

PIERRE, S. D.—Preparations are being made for the construction of an electric railway from Valentine, Neb., to Spenger, Neb. It is to run in a general easterly direction, keeping near the South Dakota line all the way, following the divide between the Niobrara and Keya Paha rivers for a considerable distance, crossing the Keya Paha near the South Dakota line, and after reaching the Ponca River following down that stream to where its eastern terminal is to be at Spender. The promoters expect to get their power for operation of the line from the Niobrara River.

NEW HAVEN, CONN.—It is asserted on good authority that the New York, New Haven & Hartford Railroad Company, in addition to the plan heretofore outlined of extending the New York & Westchester line to meet the Poughkeepsie Bridge system, will also build a connection of the Westchester line to Danbury. The most important effect of such a connection will be to shorten the line from New York to the Berkshire summer resorts by transferring to the new line passenger business now going to these resorts by way of South Norwalk and Danbury. The new line will reduce two sides of a railroad triangle to one.

HARTFORD, CONN.—The stockholders of the Farmington Street Railway Company at a special meeting voted to sell the property contracts, rights and franchises of the corporation to the New York, New Haven & Hartford Railroad Company. The Farmington Company operates a line of street cars from Hartford to Farmington and Unionville. The cars enter the center of this city over the tracks of the New Haven road. The company has $189,000 stock and $30,000 bonds and it operates 10.8 miles of road. The company has paid no dividends on its stock. It has had a traffic alliance with the New Haven road for some time.

NASHVILLE, TENN.—Much railway work is being done in this state following the recent completion of the Nashville-Franklin interurban. This enterprise met with such success that many other lines of a similar character are being projected. Indications are favorable for early work on an interurban from Nashville to Gallatin. Another line is being projected from Nashville to Lewisburg and beyond. A corporation has just been formed to build an interurban from Nashville to Adairville, Ky., and on north to a connection with the Illinois Central. The Franklin line will doubtless be extended in time to Columbia and Mt. Pleasant. Plans are being perfected to build an electric line from Nashville through Jackson to Memphis, and only a few months ago the directors of the Tennessee Traction Company, which is projecting this enterprise, met at Memphis and decided to build from that city to Jackson.

RICHMOND, VA.—The Burton Construction Company, having charge of the construction work of the Richmond and Henrico Electric Railway, is busy on detailed plans and specifications for the completion of the lines of the road. A report recently made public to the effect that lis pendens proceedings had been instituted against the electric company, was only a revival of a former action brought by parties whose claims were challenged. The management of the road has expressed some indignation, it is understood, at what they are said to consider efforts and attempts to discredit its ability to put through its plans, and the company is declared to be meeting the full conditions of its franchise, and pushing the work as rapidly as possible. A former report had it

that a receivership had been asked for, and that an attachment had been sought on a $100,000 forfeit deposited in Richmond, and these allegations are now denied as above indicated. L.

OMAHA, NEB.—The street railway company will shortly commence the construction of a power plant at Fifth and Jackson Streets, to cost $1,000,000. C.

MONTICELLO, IOWA.—The Davenport-Manchester Interurban Railway Company has increased its capital stock to $600,000. C.

WAHPETON, N. D.—The Wahpeton-Breckenridge Street Railway Company will shortly begin the construction of an electric road to Breckenridge, Minn. C.

MINNEAPOLIS, MINN.—The Twin City & Lake Superior Railway Company will issue bonds for $2,500,000 at once for the completion of its line to Duluth and Superior, which will be 130 miles long. C.

DULUTH, MINN.—The Duluth Street Railway Company will expend $350,000 next year for the improvement and extension of its property. C.

MISSOULA, MONT.—The Somers, Polson & Missoula Electric Railway Company has been organized to construct an electric line to Somers by way of St. Ignatius, Roman, Polson, Dayton, and Rollins. C.

KOKOMO, IND.—The commissioners of Howard County have been asked to call an election in Center Township to vote on a proposition of a subsidy tax of $35,000 in aid of the construction of the Kokomo Western traction line. The people favor the road since it penetrates a section that has no railroad facilities.

MADISON, WIS.—The Cincinnati Construction Company has received a certificate of convenience and necessity from the railroad rate commission for the construction of the proposed interurban line from Janesville to Madison. President H. H. Zigler of the company has stated that construction work will begin in the spring. M.

TERRE HAUTE, IND.—The Terre Haute, Indianapolis & Eastern Traction Company has selected a site and is planning for the erection of a modern interurban terminal station in this city. The estimated cost is $250,000. Terre Haute is fast becoming a great interurban center and the construction of a new station is but the carrying out of an obligation set forth in the new franchise.

WABASH, IND.—The fact that J. E. Bauket, a civil engineer in the employ of the New York Central Railroad, is assisting J. A. Barry in the construction of an electric line between Wabash and Warsaw, has given rumor that the New York Central is backing the electric work. A large force will be employed on the construction work as soon as the weather is favorable. Modern cars have been ordered from the Newark, O., shops and rails from the Bethlehem, Pa., mills.

KOKOMO, IND.—The Kokomo Western Traction Company has filed articles of incorporation with an initial capital of $10,000. The corporation proposes to promote, finance, construct, equip and operate a line of street and interurban lines in the city of Kokomo and through Howard, Carroll and Cass Counties, connecting Kokomo, Burlington, Young America, Logansport and intervening towns. The company will also distribute electricity to the towns and farming community for light, heat and power. The directors are: O. C. Gard, George W. Charles, M. R. Doyon, Andrew Johnson and C. C. McFann.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

PAINTED POST, N. Y.—The Federal Telephone Company is running lines to accommodate subscribers in new districts of the city.

WINDSOR CASTLE, PA.—The Windsor Rural Telephone and Telegraph Company has recently been incorporated with a capital of $5,000.

FERGUS FALLS, MINN.—An independent telephone company is about to be incorporated in which Joseph Gunn, of Breckenridge, Minn., is interested. C.

WADENA, MINN.—The Compton Telephone Company, capital $1,000, Geo. Stewart, clerk, will at once commence the construction of three miles of line. C.

GROTON, VT.—The Molly Falls Telephone Company has begun the construction of a trunk line from Groton to Wells River, a distance of about eight miles.

WADENA, MINN.—The Leaf River Rural Telephone Company will shortly commence the construction of a main line and two branches. Tamarack poles and steel wire have been ordered for the construction.

MINNEAPOLIS, MINN.—The Northwestern Telephone Exchange Company will expend $1,200,000 the coming year in extensions and the installation of cables. The same amount will be spent in St. Paul, Minn. C.

ORANGE, TEX.—The Orange Home Telephone Company has been incorporated with a capital of $40,000. The promotors of the company are: William D. Dean, John B. Fletcher, Hugh L. Rumkle, Allen Edwards, H. M. Shingle and E. L. Bruce.

SALISBURY, N. C.—Extensive telephone connections are being built by independent interests from this place to Lexington, Concord and other towns. The telephone company is also endeavoring to get a franchise in Spencer. The independent lines radiate out from Salisbury in all directions. L.

SANDUSKY, OHIO.—The Vermilion Telephone Company, operating the independent exchange in Vermilion, has consummated a deal whereby it will take over the Bell exchange and franchise in Vermilion. Long distance connections will be made with both the United States and Bell lines, it is said.

FAIRMOUNT, IND.—A merger of the two telephone systems in this city has been effected. The Citizens Co-Operative Telephone Company has purchased outright and taken over the complete plant including the toll lines of the Fairmount Telephone Company. The former company has been allied with the Bell Company and the latter company with the Independent system of the state. S.

WASHINGTON, PA.—The franchise granted the National Telephone Company of Pennsylvania by the council of East Washington is still in the hands of the company without their acceptance. The company was allowed thirty days in which to accept the franchise and deposit their cash bonus of $1,000, required by the terms of the franchise.

DANIELSON, CONN.—A new telephone line is being constructed from Willimantic to Chaplin by the Southern New England Telephone Company, which, when completed, will be used for toll purposes, as the other lines are more than carrying capacity at the present time. The line connects at Chaplin with the main line to Danielson.

GOSHEN, IND.—By the terms of the Goshen Telephone Company's franchise after January 1, 1910, a tax of two per cent on its gross receipts must be paid to the city for the privilege of operating in the streets and alleys. The company has prospered and it is estimated that the yearly income to the city will be not less than $3,000 for the first year and will increase as the system is further developed. S.

TAMPA, FLA.—W. G. Brorein, general manager of the Peninsular Telephone Company, has announced that within the next three months all of the overhead wires of the telephone company in the downtown district and in the residence section of Hyde Park will be placed underground. The work of laying underground wires is but the carrying out of a policy announced by the company when it purchased the interests of the Bell Telephone Company in this city.

CLARKSVILLE, TENN.—A deed has been filed for record at Clarksville by E. B. Denison, special master in the United States Circuit Court, transferring to Dancy Fort, trustee, the property of the Clarksville Home Telephone Company. This property was sold on April 2nd for $44,650. Mr. Fort represents the bondholders. The company will be reorganized and placed on a solid financial basis. Included in the sale are the Home Telephone exchanges at Clarksville, Cumberland City, Dover, Erin, Stewart and New Providence.

CLARKEVILLE, TENN.—The proceedings instituted against the Clarksville Home Telephone Company in the United States circuit court have been practically settled, a deed being filed transferring the property to Dancey Fort, trustee. Mr. Fort represents the bondholders of the company, who purchased the property at public sale in Apil. The exchanges at Clarksville, Cumberland City, Erin, Dover, Stewart and New Providence are included in the sale. The company will be reorganized at once and placed upon a sound financial basis.

MEMPHIS, TENN.—The Mississippi Home Telephone Company is pushing work rapidly on its long-distance lines into Jackson, and the statement is made that it will have reached that city by the middle of January. One of these lines runs from Jackson to Meridian and another is being constructed to Lake. A three-circuit system will be installed and toll stations will be established at all of the towns on the lines between the terminal stations. The independent company also has a line in process of construction between Jackson and Hattiesburg, which will be completed early next year.

ELECTRICAL SECURITIES.

(Special Correspondence.)

The stock market is at present in a rather dull state owing to the uncertainty of the outcome of present conflicting tendencies. In several stocks there was a considerable and sudden rise in value and yet, owing to the steps being taken by railroad employees for higher wages, and the possibilities of strikes speculators have been very careful. During the week preparations were being made to meet the January interest obligations and in New York alone the amount was estimated at $225,000,000. In addition to this $25,000,000 was paid on account of the Pennsylvania new stock subscriptions and $12,500,000 for New York, New Haven and Hartford stock.

The annual meeting of the Toledo Railways and Light Company will be held in Toledo, January 20.

On account of the annual meeting of the stockholders of the Savannah Electric Company, January 12, the transfer books will be closed from January 3 to January 12, inclusive.

A call has been issued for the annual meeting of the stockholders of the Boston Elevated Company, to be held January 3. The transfer books will be closed from December 22 until January 4.

N. W. Harris & Company, New York, have purchased $1,200,000 refunding mortgage gold five per cent bonds of the Seattle Lighting Company, dated October 1, 1909, and due October 1, 1909.

An authority in the Westinghouse company says that that company has no controlling interest in any operating company and that charges of attempted monopoly of water rights and franchise rights are without any basis.

The Coney Island & Brooklyn Railroad Company has asked the New York Public Service Commission for a rehearing on its application for permission to issue $372,000 in bonds. The commission previously allowed $107,000 of this amount, after several hearings. The request was granted, and a rehearing set for January 17, before Commissioner Bassett.

The Massachusetts Gas Commission has approved the petition of the Edison Electric Illuminating Company of Brockton for authority to issue 14,088 additional shares at $140 per share, for the payment of obligations incurred in additions. The joint petition of the Edison Electric Illuminating Company and the Bridgewater Electric Company for the purchase of the latter by the former was approved.

DIVIDENDS.

Carolina Power and Light Company; regular quarterly dividend of one and one-half per cent on the preferred stock, payable January 1 to stock of record November 30.

Central & South American Telegraph Company; quarterly dividend of one and one-half per cent, payable January 8.

Electric Light and Power Company of Abington and Rockland; semi-annual dividend of $4 per share, payable January 1, to stockholders of record December 27.

Electric Storage Battery Company; quarterly dividend of one per cent on both common and preferred. The previous payments were at the rate of three-quarters of one per cent quarterly.

Mexican Telegraph Company; quarterly dividend of two and one-half per cent, payable January 15.

Metropolitan West Side Elevated Railroad Company; a dividend of three per cent on its preferred stock for the year 1910, payable in equal quarterly installments of three-quarters of one per cent on March 1, June 1, September 1 and December 1. The previous disbursement on the issue was three-quarters of one per cent on September 30, 1907.

New England Telephone and Telegraph Company; quarterly dividend of $1.50 per share, payable January 15.

Pacific Telephone and Telegraph Company; quarterly dividend of one and one-half per cent on the preferred stock, payable January 15 to stockholders of record December 31.

Providence Telephone Company's quarterly dividend of $1 per share, payable January 1, to stockholders of record December 20.

NEW YORK.

	Dec. 27.	Dec. 20.
Allis-Chalmers common	14¾	15
Allis-Chalmers preferred	54½	54½
Amalgamated Copper	88½	88
American Tel. & Cable	*80	80
American Tel. & Tel.	142¼	142
Brooklyn Rapid Transit	79½	80
General Electric	159½	159¾
Interborough-Metropolitan common	24¾	24⅛
Interborough-Metropolitan preferred	61½	60½
Kings County Electric	129	129
Mackay Companies (Postal Telegraph and Cables) common	90¼	91
Mackay Companies (Postal Telegraph and Cables) preferred	77	79
Manhattan Elevated	137	139
Metropolitan Street Railway	..	20
New York & New Jersey Telephone	123½	123½
U. S. Steel common	91	92½
U. S. Steel preferred	125¼	125¼
Western Union	76½	78⅛
Westinghouse common	81½	82¼
Westinghouse preferred	135	133

* Last price quoted.

BOSTON.

	Dec. 27.	Dec. 20.
American Tel. & Tel.	142¼	142
Edison Elec. Illuminating	250¼	249
General Electric	159½	159¾
Massachusetts Electric common	16¼	15½
Massachusetts Electric preferred	78½	79
New England Telephone	138½	137
Western Tel. & Tel. common	16	12¾
Western Tel. & Tel. preferred	93	92

PHILADELPHIA.

	Dec. 27.	Dec. 20.
American Railways	46¾	46½
Electric Company of America	12¼	12⅝
Electric Storage Battery common	61	56
Electric Storage Battery preferred	61	56
Philadelphia Electric	13⅞	13½
Philadelphia Rapid Transit	27¼	27½
Philadelphia Traction	89	89
Union Traction	52	52¾

CHICAGO.

	Dec. 27.	Dec. 20.
Chicago Railways, Series 1	109	103
Chicago Railways, Series 2	33½	32½
Chicago Subway	4¾	4¾
Chicago Telephone	137	135
Commonwealth Edison	118½	118
Metropolitan Elevated common	16½	19
Metropolitan Elevated preferred	55½	58
National Carbon common	102	103
National Carbon preferred	122½	123

PERSONAL MENTION.

PROFESSOR A. E. KENNELLY, of Harvard University, has been appointed by the American Institute of Electrical Engineers to the presidency of the United States National Committee of the International Electrotechnical Committee.

JAMES CAMPBELL, president of the North American Company, has been elected as one of the directors of the Union Electric Light and Power Company, of St. Louis. Mr. Campbell takes the place of C. W. Wetmore, who resigned.

HARRY S. DILKEY, formerly manager of the Winona lines, has been appointed as the chief of a new department, created by the Chicago, South Bend & Northern Indiana Traction Company; the Murdock lines. He is now traffic manager, with headquarters in this city.

H. E. KAHLERT, who has for some time been with the Frank Adam Electric Company of St. Louis, has recently resigned his position with them. Mr. Kahlert resigned to accept the position of electrical engineer with the Herman Andrae Electrical Company of Milwaukee, Wis.

P. M. HAIGHT, well known in electrical circles as treasurer of the Sprague Electric Company, was recently elected to presidency of the Electrical Trades Society of New York. Mr. Haight's experience in this line, combined with enthusiastic ability, bespeaks for the society a successful administration.

G. A. RICHARDSON, who has for the past five years been superintendent of the Houghton County Traction Company, recently resigned to accept the position of traffic manager of the Seattle lines. As a testimonial of their regard, the trainmen of the company presented Mr. Richardson with a handsome remembrance.

EDWARD C. CULLEN, of Toledo, O., assistant manager of the traffic bureau of the Toledo Chamber of Commerce, has severed his connection with that organization, to take charge of the traffic department of the F. E. Bissell company with the beginning of the new year. Mr. Cullen is considered one of the most competent men in the west section in that line of work.

F. H. LINCOLN, assistant general manager of the Philadelphia Rapid Transit Company, has resigned to connect himself with the Goldschmidt Thermit Company, of New York. Mr. Lincoln had been with the Rapid Transit Company for seventeen years. Henry Branson, who has been in charge of the company's principal shops, will succeed him, with the title of superintendent of rolling stock.

THOMAS A. EDISON was the guest of honor at a recent dinner party given by a number of moving-picture manufacturers at the Hotel Plaza in New York. His hosts made the dinner an occasion in which to pay him tribute as the pioneer in the field and to signalize the completion of their first twelve months of peace, after a protracted period of costly litigation. A silver trophy depicting a Greek procession of victory was given to Mr. Edison by his associates. A special film, as a record of the dinner, was exposed.

BION J. ARNOLD, consulting engineer and traction expert of Chicago and New York, was married in New York city on Wednesday, December 22, to Mrs. Margaret L. Fonda. Mr. Arnold, who is a graduate of Hillsdale, Mich., College and the University of Nebraska, has been actively engaged in engineering work for twenty-four years. He is president of the Arnold Company, Chicago; chairman and chief engineer of the Board of Supervising Engineers, Chicago Traction, and also consulting engineer for the Public Service Commission, First District, State of New York. Mr. Arnold is a past president of the American Institute of Electrical Engineers and of the Western Society of Engineers. Mr. Arnold will continue to make his residence at 4713 Kimbark avenue, Chicago.

OBITUARY.

PROF. FRANK J. SHORT, for a time in charge of Engineering Research at Cornell University, died recently at Fort Collins, Colo., where he had gone to be treated for tuberculosis. He was graduated from the University of Wisconsin in 1897.

JEAN JACQUES BOUQUET DE LA GRYE, a distinguished French scientist, died on Wednesday in Paris in his seventy-third year. He was a member of the Institute and of the Bureau of Longitudes, and was the author of many scientific works. The best known, out of France, was "Paris, a Seaport," published in 1892. Prof. de la Grye was a Commander of the Legion of Honor.

DR. CHARLES B. DUDLEY, chief chemist for the Pennsylvania Railroad Company, died on December 22nd, in Altoona, Pa., of typhoid pneumonia, at the age of sixty-eight years. Doctor Dudley was one of the most prominent scientists in the country. He was president of the American Chemical Society, member of the Iron and Steel Institute, president of the American Society for Testing Railway Materials and was recently elected international president of the Society for Testing Materials at the meeting of the society held in Copenhagen. Doctor Dudley served in the One Hundred and Fourteenth New York Volunteers.

NEW INCORPORATIONS.

WILMINGTON, DEL.—The Electric Steel Alloys Company has been chartered with a capital of $1,000,000. The incorporators are: F. M. Shive, S. E. Roberson and H. W. Davis, Wilmington.

CHICAGO, ILL.—The Lawrence Company has been incorporated with a capital of $2,500, by Joseph Uhrig, Harry C. Kinne and John W. Lee. The company will do a general electrical manufacturing and merchandise business.

NEW YORK, N. Y.—The Nearkimsee Meter Company has been incorporated to manufacture meters and motors. The incorporators are: F. R. Kimbley, B. L. Seelye and A. J. Marshall, New York city, and the capital, $100,000.

JERSEY CITY, N. J.—The American "Z" Lamp Company has been incorporated with a capital of $1,000,000 to manufacture electric lamps. The incorporators are H. Brummer and A. Romberg, of Paris, France, and B. Treacy, of Jersey City.

SPRINGFIELD, ILL.—A charter has been granted to the Progressive Light and Power Company of Decatur, capital stock $100,000, to do a general electrical heating and merchandise business. The incorporators are Robert I. Hunt, Fred W. Ives and William Hoffman.

CHARLOTTE, N. C.—The Southern Gas and Electric Company of Charlotte, N. C., has been chartered for manufacturing purposes solely, proposing to make and install material, machinery, etc., for lighting plants. The incorporators are W. B. Wilcox, A. M. Guillette and others. L.

NEW YORK, N. Y.—The Mitchell Rand Manufacturing Company has been incorporated with a capital of $20,000. The purpose of the firm is to manufacture asphalt, waxes, electrical supplies, devices, etc., and the incorporators are Lyman F. Rand, William E. G. Mitchell and Charles L. Rand, all of Brooklyn.

NEW PUBLICATIONS.

CANADA DEPARTMENT OF MINES BULLETINS.—Recent issues include: Production of Natural Gas and Petroleum in Canada during 1907 and 1908; Production of Iron and Steel in Canada during 1907 and 1908; Production of Coal, Coke, and Peat in Canada during 1907 and 1908.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY.—Vol. 45, No. 1, of the *Bulletin* of the Institute (Boston, Mass., December, 1909), is a voluminous issue of 466 pages comprising a "Catalogue of the officers and students with a statement of the requirements for admission and a description of the courses of instruction."

THE AMERICAN INSTITUTE OF ARCHITECTS.—The quarterly bulletin (Vol. 10, No. 3) of this society, for October, 1909, which has recently been issued, contains, *inter alia*, an index of literature from the publications of architectural societies and periodicals on architecture and allied subjects, from July 1, 1909, to October 1, 1909.

LEGAL NOTES.

RIGHTS AND DUTIES WHERE EXCLUSIVE FRANCHISE HAS NOT BEEN GRANTED—A telephone company, having erected its poles and strung its wires in the streets of a city by its permission, and no fault being found with the manner in which it had been done, the United States Circuit Court of Appeals, Sixth Circuit, says, Central Union Telephone Company vs. City of Conneaut, that the city was bound to respect the rights of the telephone company thus acquired. It had not granted an exclusive franchise. It was not debarred from granting a franchise to another company to erect in its streets another telephone or lighting system, or from erecting one for itself. But in either of these events, the other company, or the city, as the case might be, would be bound to construct its lines in such manner as not to interfere unnecessarily with the poles and wires which the telephone company had rightfully constructed in the same locality. When, therefore, the city proposed to carry its electric-light wires across the telephone company's wires, it was bound at least, in the absence of any order on the telephone company to make a change in its structures, to string its wires so, if that were reasonably practicable, as not to interfere with the telephone company's lines. It could not arbitrarily string its wires so near to the wires already there as to produce a condition of danger and thereby compel the telephone company to change its structures.

NOT AN ILLEGAL DISCRIMINATION IN CHARGE FOR CURRENT—Parties who had secured a special rate for electric current in consideration of their using a certain amount of it and furnishing their own lamps were after a time changed from the wholesale rate, and thenceforward charged only for current actually consumed at the regular retail rate of ten cents per kilowatt-hour. They claimed that this retail rate was higher than that paid by other retail customers in like circumstances. This claim was based on the fact that a discount of ten per cent was allowed to theatres and music halls, break-down customers (those owning their own plant and using the company's current only occasionally), and buildings in process of construction. The reasons for the exception, which were based upon experience, were: As to the first, it was impossible for the company to properly control their lamps, which were broken and carried away by the performers and others, so the cost of maintenance was extraordinarily increased; as to the second, the lamps were worn out and injured or destroyed for the most part in the use of current other than that of the company, and the cost of maintenance rendered out of all proportion to the comparatively small amount of the company's current used; and as to the third, the breakage and loss of lamps, on account of the nature of the business, were far greater than in the case of ordinary retail customers. Hence the discount of ten per cent was allowed in lieu of furnishing and renewing the lamps. Although none of the circumstances which produced this extraordinary cost of lamp renewal was shown to exist in connection with the plaintiffs' use of electricity, they insisted that, inasmuch as they furnished their own lamps, they, too, should be allowed the ten per cent discount, and that the company's refusal to allow it to them constituted illegal discrimination against them. But the appellate term of the Supreme Court of New York holds otherwise. It says, Halpern and others vs. New York Edison Company, 113 New York Supplement, 790, that, had the company refused to furnish lamps, as well as electricity, the same as it did to other retail customers, at ten cents per kilowatt-hour, the plaintiffs would have had just cause for complaint. There was no evidence of such discrimination, however. To leave the option with them to furnish their own lamps, and then to compel the company to grant them a ten per cent reduction, would be to give every other retail customer the same right, and to brand the company's mode of dealing with its large army of retail customers as illegal.

DUTY OF LINEMEN TO INSPECT CROSS-ARMS BEFORE GOING UPON THEM—A lineman was precipitated to the ground by the breaking of a cross-arm which a subsequent examination revealed contained a knot running through it, and also a weather check, or crack, in it, caused by the expansion and contraction of the wood. Both knot hole and crack were visible. The Court of Appeals of New York holds, in an action brought to recover damages for the man's death, Johnson vs. Syracuse Lighting Company, 86 Northwestern Reporter, 539, that the company was entitled to have the jury instructed that it was the lineman's duty to inspect the cross-arm and see that it was strong and sound enough to hold him before he placed his weight thereon, particularly in a place of known danger. The duty of the company toward its employes, the court says, was to provide them with a reasonably safe place for the performance of the work required of them, but it was not an insurer of their safety. The duty rested upon its linemen to use some judgment in their dangerous occupation. The necessities of their work upon the poles, when performed at so great a distance from the ground, and dependent as it was upon the original or continued soundness of the wooden arm, demanded upon their part the exercise of the duty of inspection. While presumably the cross-arms furnished are fitted to bear the weight of the workman, perfection is not to be expected in any human system of safeguards, or of inspection, and he is not exempted from the duty of being vigilant for his own protection. In this case the lineman was working in the daytime, and it might be inferred, from all the evidence, that he might have observed the knot hole and the weather crack and have regulated his action accordingly. The company was entitled to have the jurors instructed as to what the rules of law required of both the lineman and the company in their relations.

INJURY TO LICENSEE FROM IMPERFECT INSULATION IN PRIVATELY WIRED HOUSE—Where the inside wiring for lighting by electricity of a private house, such as a shop, is done under an independent contract with the owner of the building, and is accepted by him and approved by the city inspector as sufficient, the United States Circuit Court of Appeals, Eighth Circuit, holds, in Minneapolis General Electric Company vs. Cronon, 166 Federal Reporter, 651, that such inside wires become the private property of the proprietor of the building, and are subject to his exclusive control. A third party voluntarily and uninvited entering such shop to ascertain the cause of and to extinguish a fire therein is a mere licensee, to whom the company furnishing the electric current to the house owes no obligation other than not to wantonly or knowingly injure him. And where such inside wiring becomes imperfectly insulated by the act of the owner of the building, without notice thereof to the electric company, resulting in injury to such licensee, it does not give a cause of action for such injury against the company in favor of the legal representative of the deceased licensee. The doctrine of res ipsa loquitur (the matter speaks for itself) is limited to cases of absolute duty, or an obligation practically amounting to that of an insurer. It cannot be invoked to hold liable the electric company under the circumstances of this case. Take such a city as Minneapolis, with perhaps 20,000 dwelling and business houses wired inside under an independent contract. The contract of the electric company being to furnish the required amount of electricity to light these buildings, could it, unbidden, enter at will the private house of the citizen and pass into its various rooms to inspect these wires every day to see that they are in proper condition for the reception of the electricity it has contracted to sell? Such a rule of law would tend to put concerns furnishing electricity to private houses out of business.

PROPOSALS.

POST OFFICE, ROCK ISLAND, ILL.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until February 24, 1910, for the construction (including plumbing, heating, wiring, and standard clock systems), of the extension to the United States Post Office at Rock Island, Ill., in accordance with the drawings and specification, copies of which may be had from the custodian at Rock Island, Ill., or at the Supervising Architect's office.

POST OFFICE, PAWTUCKET, R. I.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until January 25, 1910, for the extension, remodeling, etc. (including plumbing, gas piping, heating apparatus, electric conduits and wiring), of the United States Post Office at Pawtucket R. I., in accordance with the drawings and specification, copies of which may be had from the custodian at Pawtucket, R. I., or at the Supervising Architect's office.

POST OFFICE, GOLDSBORO, N. C.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until January 3, 1910, for the construction (including plumbing, gas piping, heating, apparatus, electric conduits and wiring), of an extension, remodeling, etc., to the United States Post Office at Goldsboro, North Carolina, in accordance with drawings and specification, copies of which may be obtained from the custodian at Goldsboro, N. C., or at the Supervising Architect's office.

POST OFFICE, LYNCHBURG, VA.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until February 10, 1910, for the extension, etc., except elevators (including plumbing, gas piping, heating apparatus, electric conduits and wiring and standard clock system), of the United States Post Office and Court House at Lynchburg, Va., in accordance with the drawings and specification, copies of which may be obtained from the custodian, or at the Supervising Architect's office.

STILLWATER, MINN.—The Minnesota state board of control, St. Paul, Minn., will receive bids up to noon, February 7, for the erection and completion of the new buildings and improvements for the state prison at Oak Park. Bids will be received for the work as a whole or for sections, one of which will be for the entire mechanical equipment, including electric, water and sewer work, power plant, heating, ventilating and plumbing. Checks for $3,000 must accompany bids for this division of the work. Clarence H. Johnston, of St. Paul, is the architect, and Chas. L. Pillsbury, of Minneapolis, the consulting engineer for the improvements. C.

INDUSTRIAL ITEMS.

The PHELPHS MANUFACTURING COMPANY, Detroit, Mich., is distributing an attractive booklet devoted to its "So-Easy" electric iron, which derives its name from its simple construction.

C. W. HUNT COMPANY, New York, N. Y., has recently issued Catalogue 096, on dumping tubs and grab buckets. Besides many typical illustrations of these buckets, there are also pictures of Hunt standard elevating machinery, electric and steam hoists, overhead trolleys as for coal handling, etc.

THE HEXAGON TOOL COMPANY, Dover, N. H., is distributing literature descriptive of its new saw-trimmer. The manufacturers claim that this machine will perform every operation that comes to the hands of the compositor, such as sawing all kinds of cuts, plates, slugs and printing material.

THE SAMSON CORDAGE WORKS, Boston, Mass., manufacturers of the well-known Samson spot cord, is distributing its attractive catalogue-calendar for 1910. This company manufactures sash cord ranging in size from three-sixteenths of an inch diameter to three-eighths of an inch. A full line of linen and Italian hemp cord is also carried in stock.

THE GOODWIN & KINTZ COMPANY, Winsted, Conn., announces that it has opened a salesroom at 25 West Broadway, New York, N. Y., where they will display a full line of goods, including gas and electric portables, electroliers, dining room domes, art glass shades and other lighting specialties; also clocks and metal fancy goods in large variety.

F. B. BADT & COMPANY, Monadnock Block, Chicago, Ill., electrical and mechanical engineers and western selling agents for Weston instruments and Ward Leonard rheostats, etc., are sending out a unique Christmas announcement. It contains the pronunciation and derivation of some French terms used in automobiling, such as chauffeur, garage, etc.

DOSSERT & COMPANY, of New York, have concluded an arrangement through the Western Electric Company, appointing the last named company's representative, Mr. J. W. Keefe, at Johannesburg, sole agent for Dossert connectors in South Africa. Mr. Keefe has just cabled orders for 2,500 Dossert connectors of various types, to be used in extensive electrical installations in South African mines.

THE LORD ELECTRIC COMPANY, New York, N. Y., manufacturers of protective and economizing devices, announces that one satisfied customer has purchased 1,500 lightning arresters from them during the year 1909, and not one of these has proven defective. This is one of many customers who are getting satisfaction from the Lord products.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., is distributing an attractive booklet entitled, "The Power Solicitor." It contains convincing arguments in favor of Wagner motors and illustrations of their application. Among the interesting views shown is one showing a Wagner motor driving a brick machine, and another showing a Wagner motor installed in a cement mill.

THE NATIONAL METAL MOLDING COMPANY, Pittsburg, Pa., has recently distributed a folder descriptive of the new "Flexduct." The features of construction used in the manufacture of Flexduct, produce a flexible non-metallic conduit. The spiral fibre tube interwoven with warp forms an interior of great strength and prevents clogging. The interior is thoroughly soapstoned, making it moisture-proof.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, Pittsburg, Pa., has recently distributed Circular No. 1506, entitled "Recent Types of Arc Lamps and their Operation." It contains an abstract of a paper read before the National Electric Light Association by C. E. Stephens. In connection with this there are reproduced views of the various apparatus supplied by the Westinghouse Company.

THE SAFETY ELECTRIC COMPANY, Chicago, Ill., has extended, through H. A. Baum, its secretary and treasurer, an invitation to all out of town electrical men visiting the Chicago Electrical Show to inspect the company's factory and become acquainted with the value of refilled incandescent lamps. Mr. Baum reports heavy demands for the company's lamps and looks forward to a very busy year in the refilled lamp industry.

THE ELECTRIC CONTROLLER AND MANUFACTURING COMPANY, Cleveland, O., is distributing the December issue of "Common Sense," its regular monthly publication. This number is particularly attractive both in point of reading matter and appearance. The reading pages are preceded by a brief article relative to the business policy of the company, and this is followed by illustrations of the offices and factory. The interesting articles are many and this issue well deserves the title of "Christmas Number."

THE OHIO BRASS COMPANY, Mansfield, O., is distributing a bulletin devoted to electric railway and mine haulage material. The feature of this issue is an abstract of the paper on the Cascade Tunnel electrification, presented before the American Institute of Electrical Engineers by Dr. Cary T. Hutchinson. The Ohio Brass Company designed the overhead construction and manufactured all the overhead material used for this installation. This bulletin also contains an illustrated description of the company's factory.

ALLIS-CHALMERS COMPANY, of Milwaukee, Wis., has secured the contract for the pumping machinery for the new filtration plant and high service station at Niagara Falls, N. Y. For handling the water there will be three sixteen-inch, single-stage, centrifugal pumps direct-connected to forty-horsepower, wound-rotor, induction motors. These pumps will each deliver 4,200 gallons of water per minute against a head of twenty-five feet. The service system will be handled by six fourteen-inch, two-stage, centrifugal pumps direct-connected to 300-horsepower induction motors. Each pump will have a capacity of 4,200 gallons of water per minute against a head of 185 feet. For fire protection these pumps can be connected in series, in pairs, so as to double the head. With the pumping equipment there are also furnished three 625-kilowatt-ampere, 11,000-440 volt, twenty-five-cycle, three-phase transformers and two switchboards. W. P. Robbins, former city engineer, has charge of the new waterworks.

THE OHIO BRASS COMPANY, Mansfield, O., announces that the Holabird-Reynolds Company, of San Francisco, Holabird-Reynolds Electric Company of Los Angeles, and Holabird Electric Company of Seattle, have been duly appointed as its exclusive sales agents for O-B Hi-Tension porcelain insulators in the states of California, Oregon and Washington. The Holabird Companies are sales agents for Hi-Tension porcelain insulators only and the Pierson, Roeding & Company, with offices at San Francisco, Los Angeles and Seattle will continue to be the exclusive sales agents for overhead material, rail bonds, car equipment specialties and catenary material, including such special porcelain insulators as are used in catenary construction. The company also announces that it has appointed the Hendrie & Bolthoff Manufacturing and Supply Company, Denver, Colorado, as special sales agents, and they will solicit orders for materials from the Mining Trades in Colorado, Wyoming, Utah, Arizona and New Mexico, as well as from certain railway properties located in the mining districts of that territory. The business of railway and mining companies located at Salt Lake City, Denver, Cheyenne, Colorado Springs, Pueblo and Telluride will be, as heretofore, handled by F. V. Cook, who will also give special attention to Hi-Tension insulator business in all five of the states mentioned. J. C. Barr, 84 State Street, Boston, Mass., has been appointed Boston sales agent, and will solicit business in all of the New England states, with the exception of Connecticut. R. G. Campbell, of the New York office, will continue to visit the trade in Connecticut, in addition to his other territory.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., is distributing Bulletin No. 4,705, entitled "Curtis Steam Turbines for Low Pressure and Mixed Pressure," which contains considerable information of interest and value to the central station manager. As the subject indicates, the publication deals with turbines of both the low pressure and the mixed pressure types, and those with horizontal and with vertical shafts. The publication relates to two cases: First, turbines in connection with engines which are run non-condensing; second, in connection with condensing engines. Horizontal turbines of this type are built with capacities of from 300 to 2,000 kilowatts, and for twenty-five and sixty cycles. This publication contains also dimension diagrams of the horizontal type of turbine. This company is also distributing a very attractive pamphlet, entitled "The Dawn of a New Era in Lighting," which takes up the history of light from the tallow dip to the latest development in artificial lighting, namely, the tungsten lamp. Following the historical facts, the pamphlet is given up to the description of the tungsten lamp, its efficiency, cost of operation and various applications of the lamp in interior lighting.

DATES AHEAD.

South Dakota State Independent Telephone Association, Hudson, South Dakota, January 11-13, 1910.

Chicago Electrical Show, Coliseum, Chicago, January 15 to 29, 1910

Wisconsin Electrical Association. Annual convention, Milwaukee, Wis., January 19 and 20, 1910.

San Francisco Electrical Exposition, January 29, February 5, 1910.

Toledo Electrical Show, Coliseum, Toledo, Ohio, January 31-February 5, 1910.

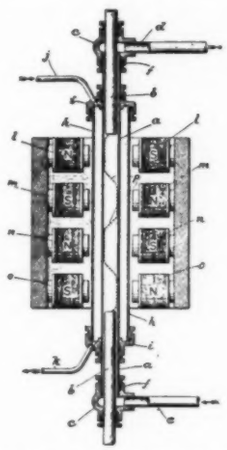
Philadelphia Electrical Exposition, Philadelphia, Pa., February 14-26, 1910.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) December 21, 1909.

943,647. BURGLAR-PROOF LOCK. Isaac L. Bridges, Powersville, Mo. Filed April 10, 1909. An electric circuit is closed by the weight of a person treading on the step.

943,661. PRODUCTION OF OXIDES OF NITROGEN FROM THE AIR. Francis I. du Pont, Wilmington, Del., assignor to the E. I. du Pont de Nemours Powder Company, Wilmington, Del. Filed December 18, 1908. A number of oppositely placed rotary magnetic fields extend longitudinally between the electrodes.



943,661.—PRODUCTION OF OXIDES OF NITROGEN FROM THE AIR.

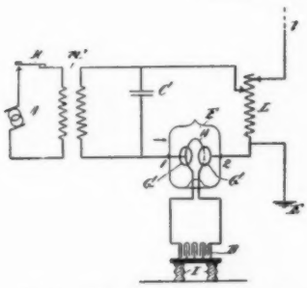
The degree of opening of the inlet valve is regulated by the expansion or contraction of an electrical conductor due to the heat generated by the current passing through it.

943,772. INCANDESCENT LAMP SOCKET. Leo Dorner and George H. Norquist, Denver, Colo.; said Norquist assignor to Robert S. Willoughby, Denver, Colo. Filed December 11, 1908. Has special locking features.

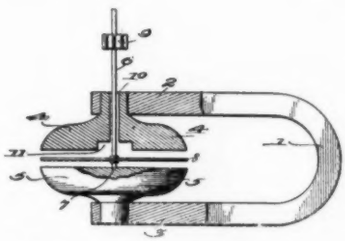
943,773. TELEPHONE DESK SET. Claude D. Enochs, La Crosse, Wis., assignor to the Vote-Berger Company. Filed April 10, 1908. Describes in detail a form of portable desk telephone.

943,792. PORTABLE LAMP-GUARD. William T. Russell, Wellesley, Mass. Filed October 7, 1907. Includes a wire guard and a hook for hanging up.

943,809. RAILWAY ELECTRIC SWITCH. Roy B. Bryant, Nashville, Ark. Filed February 11, 1908. There are two coils the energizing currents for which are applied differentially by the action of the controller and trolley wheel.



943,969.—SPACE TELEGRAPHY.



944,061.—ELECTRICAL MEASURING INSTRUMENT.

943,681. SEPARABLE ATTACHMENT-PLUG. Harvey Hubbell, Bridgeport, Conn. Filed June 5, 1908. The cable end is held seated by tightly drawing and fastening the wire thereof in the plug.

943,697. MAGNETO-ELECTRIC MACHINE. Theodor M. Mueller, Dalton, Mass. Filed February 25, 1909. An adjustable, but normally stationary element is located between the permanent field magnets and the inductor element to vary the flux through the latter. The inductor element carries means for making and breaking the primary circuit of an induction coil the core of which is included in the magnetic circuit of the machine.

943,698. ELECTRIC FUSE. Thomas E. Murray, New York, N. Y. Filed February 8, 1909. Strips of metal diverge radially from two sleeves of metal and extend between them, and two flanged covers unitedly inclose the fuse strips and have central openings for receiving the sleeves.

943,699. SWITCHBOARD AND CUT-OUT. Thomas E. Murray, New York, N. Y. Filed June 1, 1909. Removable means operative from the exterior of the block of refractory insulating material (containing mutually crossing circuit conductors each separately inclosed in the block) are provided for electrically connecting the conductors within the block.

943,721. ELECTROPLATING TANK. George L. Wallace, Bridgeport, Conn. Filed April 1, 1909. Includes a cylindrical, inclined tumbling device.

943,726. REGULATOR FOR INTERNAL-COMBUSTION ENGINES. Maurice J. Wohl and Harry Hertzberg, New York, N. Y., assignors to Abbot A. Low, Horseshoe, N. Y. Filed March 4, 1908.

943,831. TWO-POLE SNAP-SWITCH. Louis Kellner, New York, N. Y., assignor to Metropolitan Switchboard Company. Filed November 17, 1908. The push buttons engage with a rocker plate through link connections.

943,861. ELECTRIC WELDING MACHINE. Alvin E. Buchenberg, Toledo, Ohio, assignor to the Toledo Electric Welding Company. Filed March 26, 1909. Includes a number of work-gripping levers, and loop means movable to effect a positive oscillation of the levers in unison to grip the work and move it to and fro.

943,883. ELECTRICAL SIGNALING AND SWITCHING APPARATUS. Ray H. Manson, Elyria, Ohio, assignor to the Dean Electric Company. Original application ,filed June 14, 1905. Divided and this application filed May 29, 1907. Describes a form of annunciator.

943,893. ADVERTISING APPARATUS. William J. Rider, Wimbledon, England. Filed December 20, 1906. Chains carrying electrically illuminated advertising cards are driven through sprockets by an electric motor.

943,914. SWITCH INDICATOR. Charles A. Clark, Hartford, Conn., assignor to Trumbull Electric Manufacturing Company. Filed September 21, 1908. An indicator is rotarily mounted and is provided with operative means for engaging a movable part of the switch mechanism.

943,915. MULTIPLEX TRANSMITTER. John J. Comer, Baltimore, Md., assignor to George R. Webb, Baltimore, Md. Filed April 7, 1909. A telephone instrument receives vibrations from a record.

943,918. ELECTRICAL MEDICAL APPLIANCE. Benjamin R. Davenport, Philadelphia, Pa., assignor to Electric Couch Company. Filed May 15, 1908. A person whose body is in contact with the device may receive shocks through terminal contacts at predetermined intervals.

943,931. DAMPER REGULATOR. Frederick C. Guptill, Elgin, Ill., assignor of one-half to William F. Lynch, Elgin, Ill. Filed November 9, 1908. A thermostat controls electric circuits.

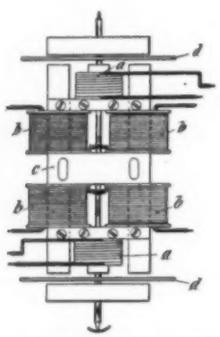
943,933. ELECTRIC CLOCK SYSTEM. Harry O. Harrison, Wichita, Kan., assignor of one-half to Samuel McCreary, Wichita, Kan. Filed March 16, 1909. A master clock electrically controls a number of local clocks.

943,940. THEATER CHAIR SIGNAL SYSTEM. Paul T. Kenny, New York, N. Y. Filed November 24, 1908. The weight of a person sitting on a chair electrically actuates a signal.

943,946. TELEPHONE MOUTHPIECE. Edward H. Long, Los Angeles, Cal. Filed December 10, 1908. Two parts are secured together by attaching prongs.

943,958. FLUSH PLATE FOR FLUSH RECEPTACLES. Frank T. Wheeler, Plainville, Conn., assignor to the Trumbull Electric Manufacturing Company. Filed December 7, 1906. The faceplate has a hinged trap, is of substantially circular form with an integral projection, the whole pressed out of the faceplate and pivoted in the opening thus formed.

943,960. SYSTEM OF DIRECTED WIRELESS TELEGRAPHY. Ettore Bellini and Alessandro Tosi, Paris, France. Filed October 1, 1907. Several dirigible aerials in a fixed position are combined with fixed windings inserted in the conducting part of the aerials. A rotary device is connected to a wave generator and excites the fixed windings.



944,167.—INDUCTION SUPPLY-METER FOR POLYPHASE CURRENTS.

943,969. SPACE TELEGRAPHY. Lee de Forest, New York, N. Y., assignor to De Forest Radio Telephone Company. Filed January 29, 1907. The circuit includes a source of electrical energy and a condenser. A discharger comprises an evacuated vessel, two electrodes sealed therein, and means maintaining a heated gas in the vessel.

944,003. ELECTRIC SIGNAL SYSTEM. Alfred L. Sohm, Los Angeles, Cal. Filed September 24, 1907. A signal indicator includes a local circuit which comprises means to indicate the station from which the signal is sent.

944,040. OVERLOAD AND REVERSE CURRENT RELAY. Pierre O. Keilholtz, Baltimore, and Forrest E. Ricketts, Derwood, Md. Filed August 5, 1908. A reaction between a rotor and a system of electromagnets is produced which is proportional to the resultant phase composition of the current and voltage elements of the circuit to be controlled.

944,050. ELECTRICAL STEAM-GENERATOR. Eleazer I. Rains, New York, N. Y. Filed February 11, 1909. Includes a number of separate water containers each heated electrically and independently.

944,060. RHEOSTAT. Herbert L. Truesdale, Somerville, Mass. Filed August 20, 1909. Describes a form of fluid rheostat.

944,061. ELECTRICAL MEASURING INSTRUMENT. Thomas W. Varley, New York, N. Y., assignor of one-half to Walter S. Rugg, New York, N. Y. Filed February 3, 1906. A coil is adapted to shift or distort the field of a constant magnet, and a winding forming a disk armature in the field responds to the shifting or distorting thereof.

944,066. DISINFECTING ATTACHMENT FOR TELEPHONES. Russell B. Adams and Llewellyn Adams, Westerville, Ohio. Filed May 1, 1909. Disinfecting liquid may be sprayed into the mouthpiece.

944,078. COUPLING FOR BATTERY ELEMENTS. Frank A. Decker, Philadelphia, Pa., assignor to Decker Electrical Manufacturing Company. Filed October 5, 1906. Renewed November 11, 1909. Describes the attachment of and for an electrode.

944,079. ELECTRIC BATTERY. Frank A. Decker, Philadelphia, Pa., assignor to Decker Electrical Manufacturing Company. Filed June 20, 1907. Renewed November 11, 1909. The vessel includes a number of removable cells each having a resistance duct connecting its interior and the interior of the vessel.

944,120. TELEPHONE EXCHANGE SYSTEM. William A. Wynne, Raleigh, N. C. Filed March 9, 1909. A relay common to all the lines acts when any line comes into use to connect them all directly with the operator's circuit.

944,131. OVERHEAD SWITCH FOR ELECTRIC RAILWAYS. Edward E. Gilmore, Philadelphia, Pa. Filed September 27, 1905. An intermediate flange extends between the main-line terminals parallel to one side flange and shaped in section so as to leave a groove on that side and to have a gradual slope on the other.

944,139. ELECTRODE FOR ELECTRIC ARC LAMPS. Adrian D. Jones, Holloway, London, England. Filed April 18, 1908. Renewed October 11, 1909. Is comprised of a mixture including calcium tungstate and calcium fluoride, with or without a steadying salt of an alkali metal.

944,167. INDUCTION SUPPLY METER FOR POLYPHASE ELECTRIC CURRENTS. Hermann Aron, Charlottenburg, Germany. Filed July 28, 1908. Two sets of driving coils are disposed one above the other and comprise series coils and pressure coils (with iron cores) for both sets. The iron cores consist of one H-shaped body having a part which constitutes a passage for the lines of magnetic force of both sets. A driving desk is provided for each set.

944,186. OVERHEAD CONSTRUCTION FOR ELECTRIC RAILWAYS. Edward E. Gilmore, Philadelphia, Pa. Filed July 18, 1907. Describes a form of overhead switch.

944,208. ELECTRIC LAMP SOCKET. Frederick P. Poole, Bridgeport, Conn., assignor to the Perkins Electric Switch Manufacturing Company. Filed September 21, 1909. The key spindle has a cam to act on the contact piece.

944,227. TELEPHONE SYSTEM. William A. Wynne, Raleigh, N. C. Filed May 15, 1909. The lines are interconnected by operators' link circuits.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired December 27, 1909:

488,536. ELECTRIC ANNUNCIATOR. Jas. H. Bates, Hoboken, N. J.

488,550. ELECTRICALLY REPEATING SIGNAL. Stephen D. Field, Yonkers, N. Y.

488,567. ELECTRIC ANNUNCIATOR. Adelvin B. Lyman, Cleveland, Ohio.

488,585. ELECTRIC ARC LAMP. Elihu Thomson, New Britain, Conn.

488,615 ELECTRIC RAILWAY SIGNAL. Frank P. Schlosser, Birmingham, Ala.

488,635. INCANDESCENT ELECTRIC LAMP. Frederick H. Prentiss, New York, N. Y.

488,636. INCANDESCENT LAMP. Frederick H. Prentiss, New York, N. Y.

488,666. ELECTRIC TELEPHONIC SWITCH AND SYSTEM. Thomas B. Sloer, Devizes, England.

488,726. SECONDARY BATTERY. Nicholas Wladimiroff, St. Petersburg, Russia.

488,738. CLOSED-CONDUIT FOR ELECTRIC RAILWAYS. Frank Mansfield, New York, N. Y.

488,740. ELECTRICAL SWITCH. Chas. E. Pattison, Boston, Mass.

488,835. REGULATING SOCKET FOR INCANDESCENT ELECTRIC LAMPS. Elias E. Ries, Baltimore, Md.

488,871. ELECTRICAL SOLDERING IRON. Chas. L. Coffin, Detroit, Mich.

488,872. ELECTRICALLY HEATED SOLDERING IRON. Chas. L. Coffin, Detroit, Mich.

488,889. ELECTRIC CIGAR LIGHTER. Edward T. Gutberlet and Wm. R. Issard, St. Louis, Mo.

488,899. NON-SPARKING ELECTRIC SWITCH. Gwynne E. Painter, Baltimore, Md.

488,928. SYSTEM OF ELECTRIC DISTRIBUTION. Chas. J. Van Depoele, Lynn, Mass.

488,929. ELECTRIC RAILWAY TROLLEY. Chas. J. Van Depoele, Lynn, Mass.

488,930. ELECTRIC LOCOMOTIVE. Chas. J. Van Depoele, Lynn, Mass.

488,939. COMBINED BILL AND LETTER FILE AND PERFORATING APPLIANCE. John W. Grantland, Philadelphia, Pa.

488,951. REGULATING SOCKET FOR INCANDESCENT ELECTRIC LAMPS. Elias E. Ries, Baltimore, Md.